MAY 1957—SIXTY-THIRD YEAR

MACHINERY

Cut Floor-to-Floor Time Up to 65%!

Only Brown & Sharpe Universal Grinders provide these 4 time-saving features: **1. Completely Universal Wheel Spindle Head On Turret** for extended capacity, maximum rigidity and versatility. **2. ELECTRALIGN Measuring Arrangement** for fast, positive alignment to 0.0001". **3. Set-Diamond Wheel Truing Attachment For Internal Grinding** automatically re-establishes size after each truing. **4. Power And Hand Cross Feed In Both Directions** for internal and external cylindrical grinding to a common, positive stop. Four machine sizes. Write Brown & Sharpe Mfg. Co., Providence, Rhode Island.

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How to get TOP PRECISION PRODUCTION from your Heald Bore-Matics

Sharpen your tools with Heald Precision on a Model 3 Tool Sharpener

HERE, in the plant of a large and progressive automotive manufacturer, is a "production line" for producing *precision production!* These Heald Model 3 Tool Sharpeners serve the cutting tools for a host of Heald Bore-Matics and other precision finishing machines throughout the plant.

By replacing obsolete offhand grinding methods with *machine precision*, any required tool shape can be exactly duplicated again and again. More precisely ground and *sharper* tools not only last longer — they enable you to get top precision and full production from your Heald Bore-Matics, too. After all, it's the *tool* that does the *work!* For complete information, send for Bulletin No. 2-4-2, Issue 1.

IT PAYS TO COME TO HEALD

THE HEALD MACHINE COMPANY Worcester 6, Massachusetts

Subsidiary of The Cincinnati Milling Machine Co.

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

HEALD ®

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Machinery

VOLUME 63 MAY 1957 NUMBER 9

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Fig. 1

4 feet of thread *per minute*

with the LANHYROL thread rolling machine

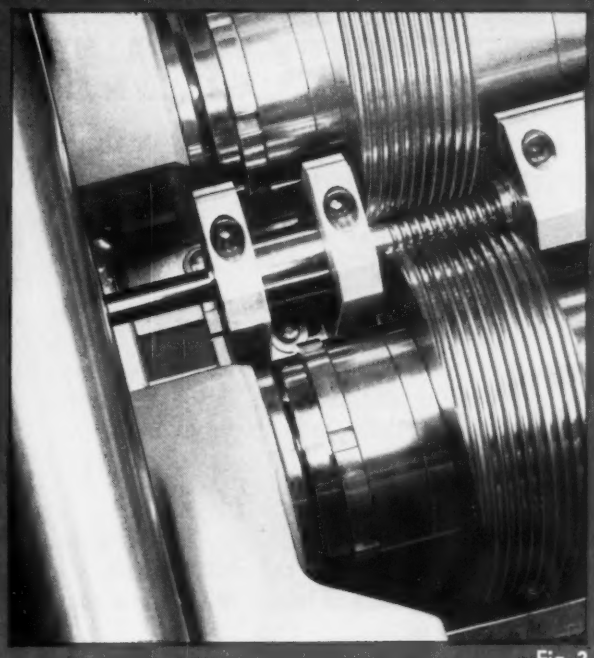


Fig. 2

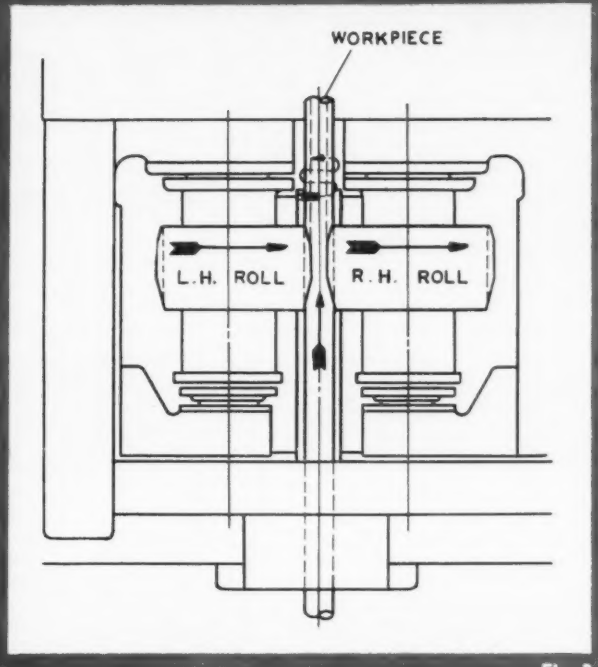


Fig. 3

LANDIS *Machine* COMPANY
WAYNESBORO · PENNSYLVANIA

The LANHYROL Thread Rolling Machine has shown outstanding results in output and thread quality producing ¾" jack screws at the M & S Manufacturing Company in Hudson, Michigan.

20-foot bar lengths of C1117 steel are being formed by Thrufeed Rolling at the rate of 48 linear inches per minute. The ¾"—6 pitch left-hand Acme threads are held within .001" on the pitch diameter throughout the entire bar length. Over 59,000 feet of thread have been produced with a set of roll dies.

Thrufeed Rolling is designed for workpieces requiring threads on the maximum diameter only or for headed parts with over 5⅞" of thread length. In this application, the workpiece is placed in a feeding tube which is halved for loading convenience (Figure 1). It is then passed axially into ball-bearing work supports and between the rolls (Figure 2). Rolls with a throat section for progressive generation of the thread provide a self-leading action as the threads are formed (Figure 3). Operation is continuous, with rolls revolving at correct fixed center distance. The right-hand roll unit may be retracted at anytime for set-up adjustment or stock removal.

The LANHYROL Machine also produces quality threads at high rates of output by the Infeed and Continuous rolling methods. Its range and flexibility is so great that we recommend your consideration of this equipment for any job requiring precision threads of excellent finish at high production rates. Please send specifications and ask for Bulletin E-60.

485C

For more information fill in page number on Inquiry Card, on page 241

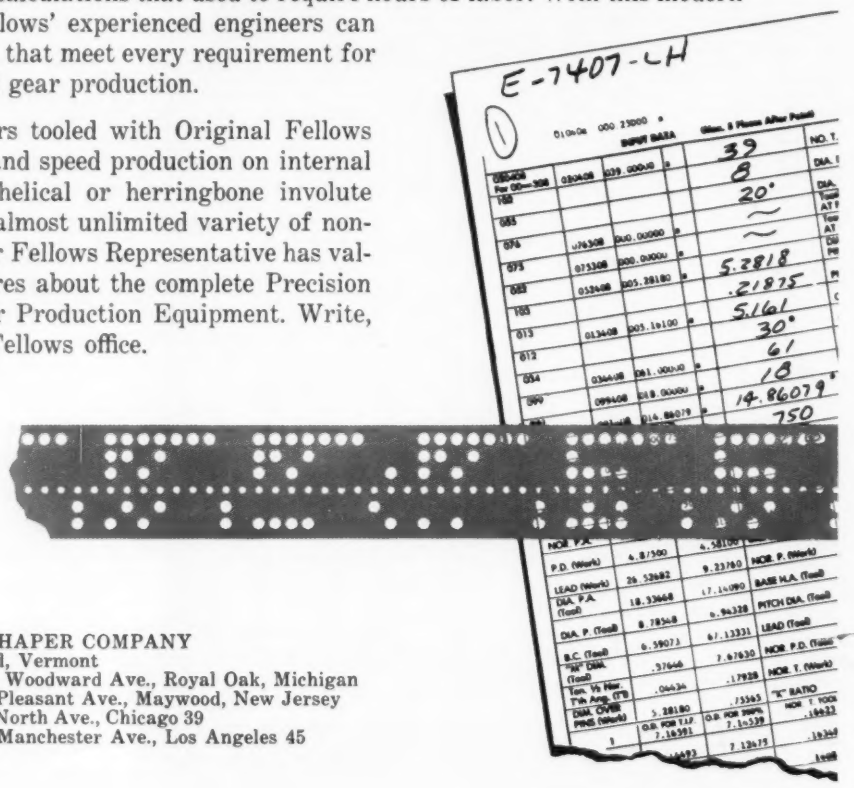
BETTER GEARS

Original Fellows Cutters "Computer-Designed"

Here's how Fellows ensures gear cutter design that meets your most critical requirements! A high-speed Bendix Computer (at right) shortens hours of calculations to minutes, permitting complete mathematical study of all the complex problems of gear and cutter design.

The punched tape holds the basic formulae. This is the computer "program." Variables for a particular Fellows Cutter, Shaving Tool, or Master Gear are typed on the electric typewriter which feeds them into the computer. As fast as the operator can type, the computer makes calculations that used to require hours of labor. With this modern calculating tool, Fellows' experienced engineers can better design cutters that meet every requirement for accurate, economical gear production.

Fellows Gear Shapers tooled with Original Fellows Cutters lower costs and speed production on internal and external spur, helical or herringbone involute gears, as well as an almost unlimited variety of non-involute shapes. Your Fellows Representative has valuable facts and figures about the complete Precision Line of Fellows Gear Production Equipment. Write, wire or phone any Fellows office.



THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Michigan
150 West Pleasant Ave., Maywood, New Jersey
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THE PRECISION LINE

START HERE!

JOB NO. 3449-56
Work Cutter Input - Max 6 Digits - 3 Before Point 5 After Point (Automatic Zeros) Enter All Angles as Decimals
Fill In One Value Only
THE FELLOWS GEAR SHAPER CO. SPRINGFIELD VT

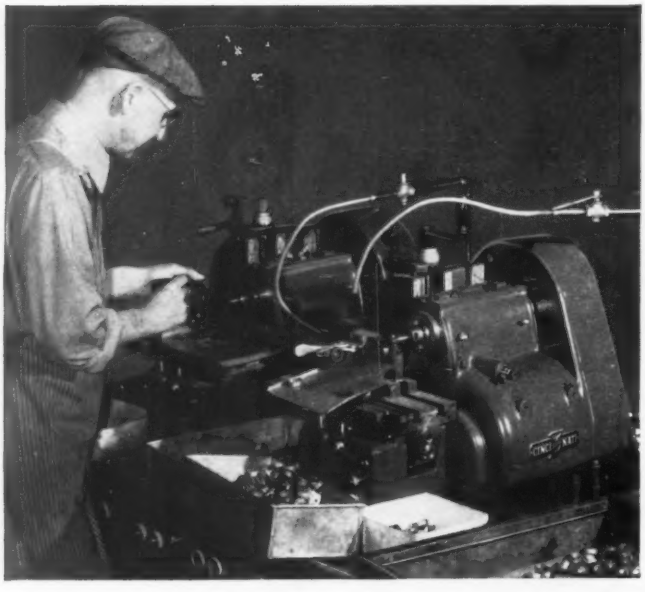
Taped "computer program" has punched holes to control computer operations.

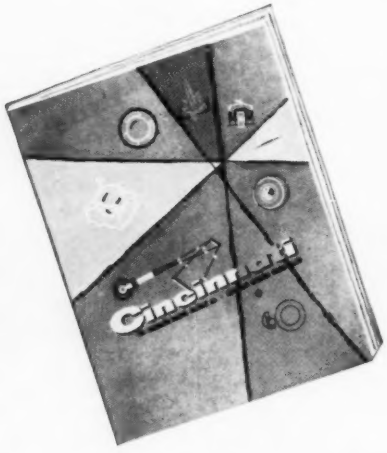
Fellows *Gear Production Equipment*

For Big Milling Jobs

...or small ones

Cincinnati will supply the equipment
to meet your requirements



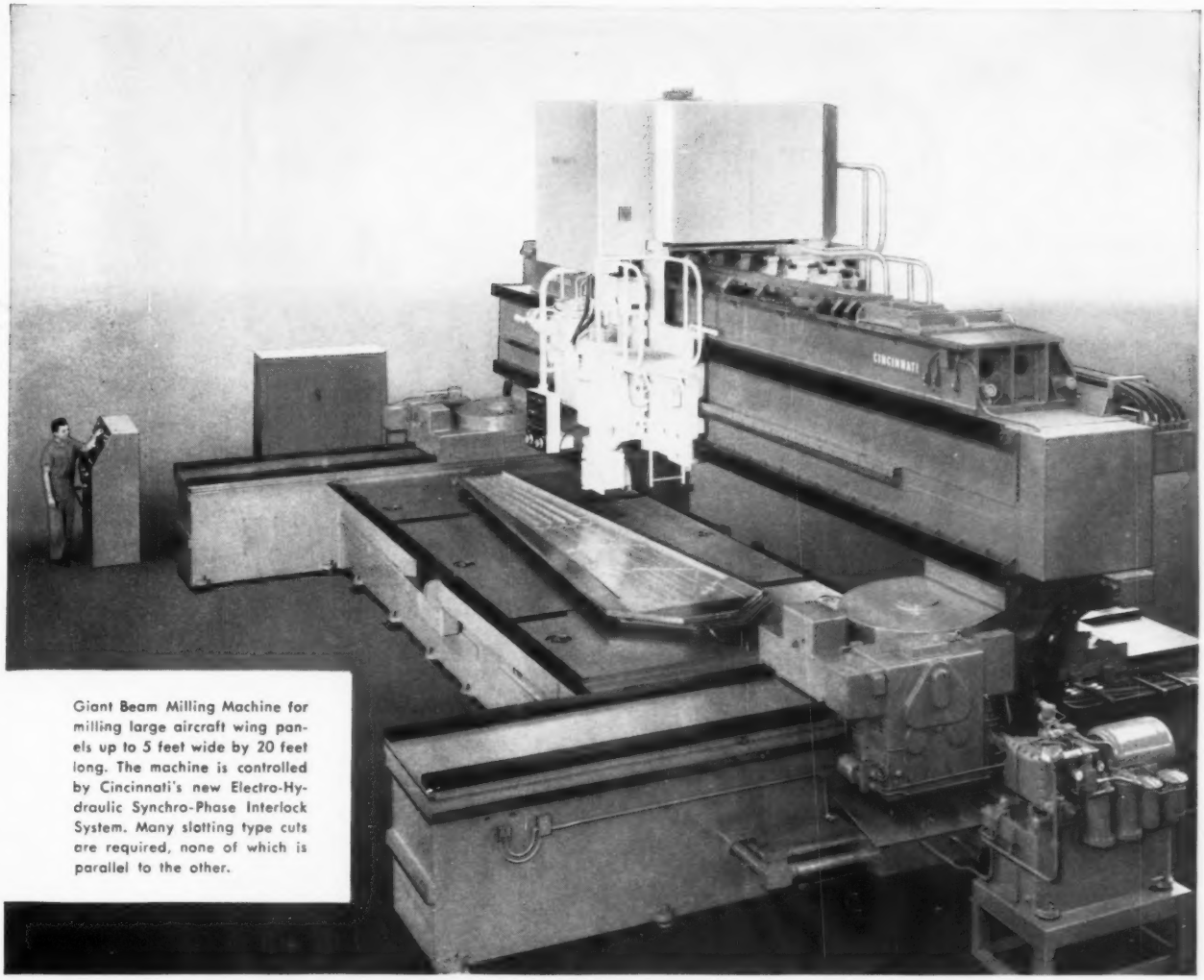


Left: The smallest of the Cincinnati line, No. 000-4 Automatic, mills sewing machine parts in the plant of a prominent manufacturer.

Above: New general catalog published by The Cincinnati Milling Machine Co. Publication No. M-1961.

CINCINNATI

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • METAL FORMING MACHINES



Giant Beam Milling Machine for milling large aircraft wing panels up to 5 feet wide by 20 feet long. The machine is controlled by Cincinnati's new Electro-Hydraulic Synchro-Phase Interlock System. Many slotting type cuts are required, none of which is parallel to the other.

Dump your cost-of-machining problems in our lap. The country's best metalworking industries have been doing it for over 30 years, and coming out way ahead in modern methods and low costs. Cincinnati Milling has the facilities, experience and line of standard equipment to fully satisfy your requirements. Milling machines built by Cincinnati range from the midget 000-4 Automatic at the left to this giant Beam Miller; hundreds of sizes and types in between; standard and specials. ¶ A new general catalog just off the press illustrates and briefly describes Cincinnati's complete line of standard machine tools, hardening machines, grinding wheels and cutting fluids. In addition, there's a section on special machine tools. You will find a duplicate of this catalog in Sweet's Machine Tool File. If you would like to have your own copy we will promptly send one to you. Ask for publication No. M-1961.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

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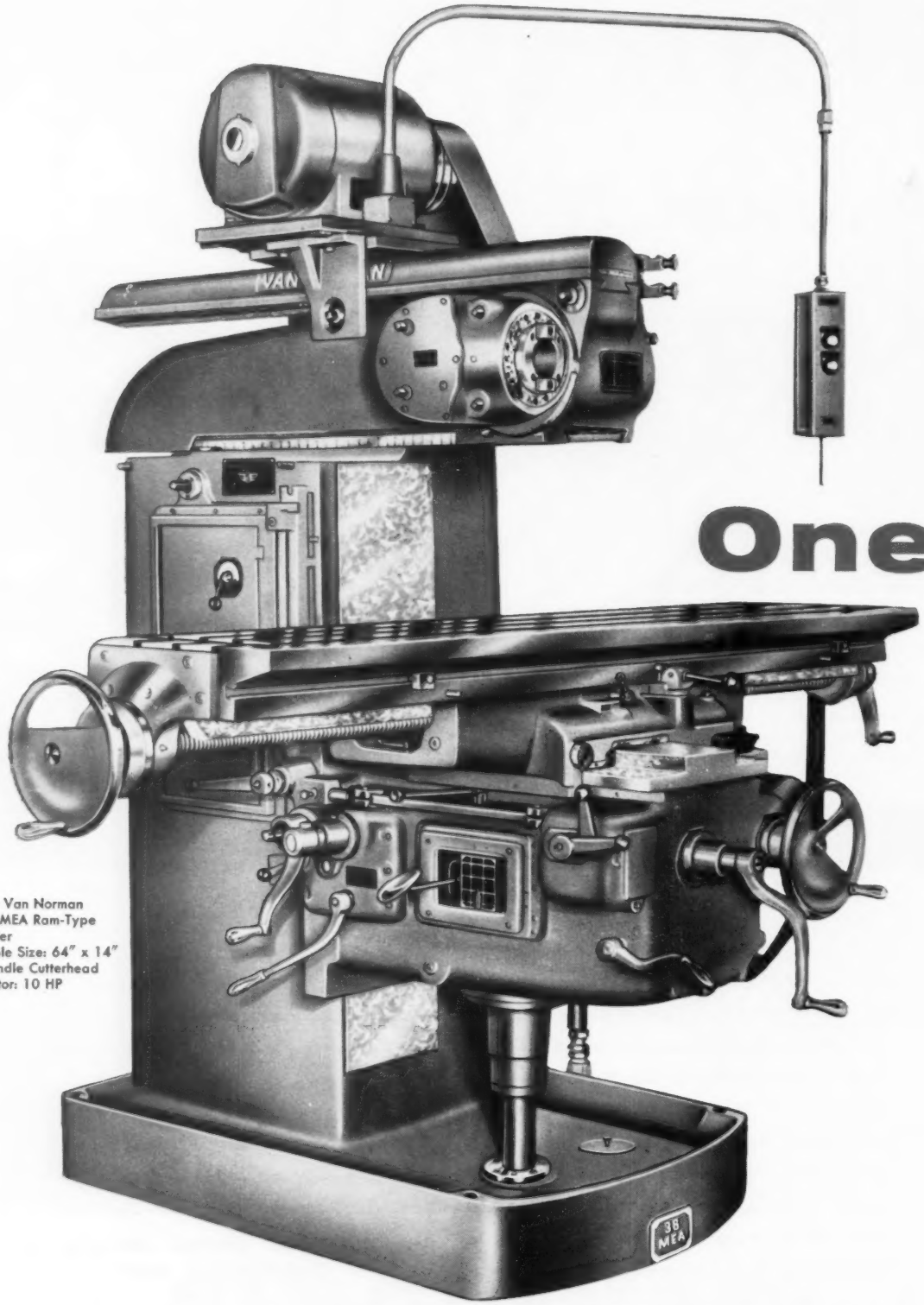


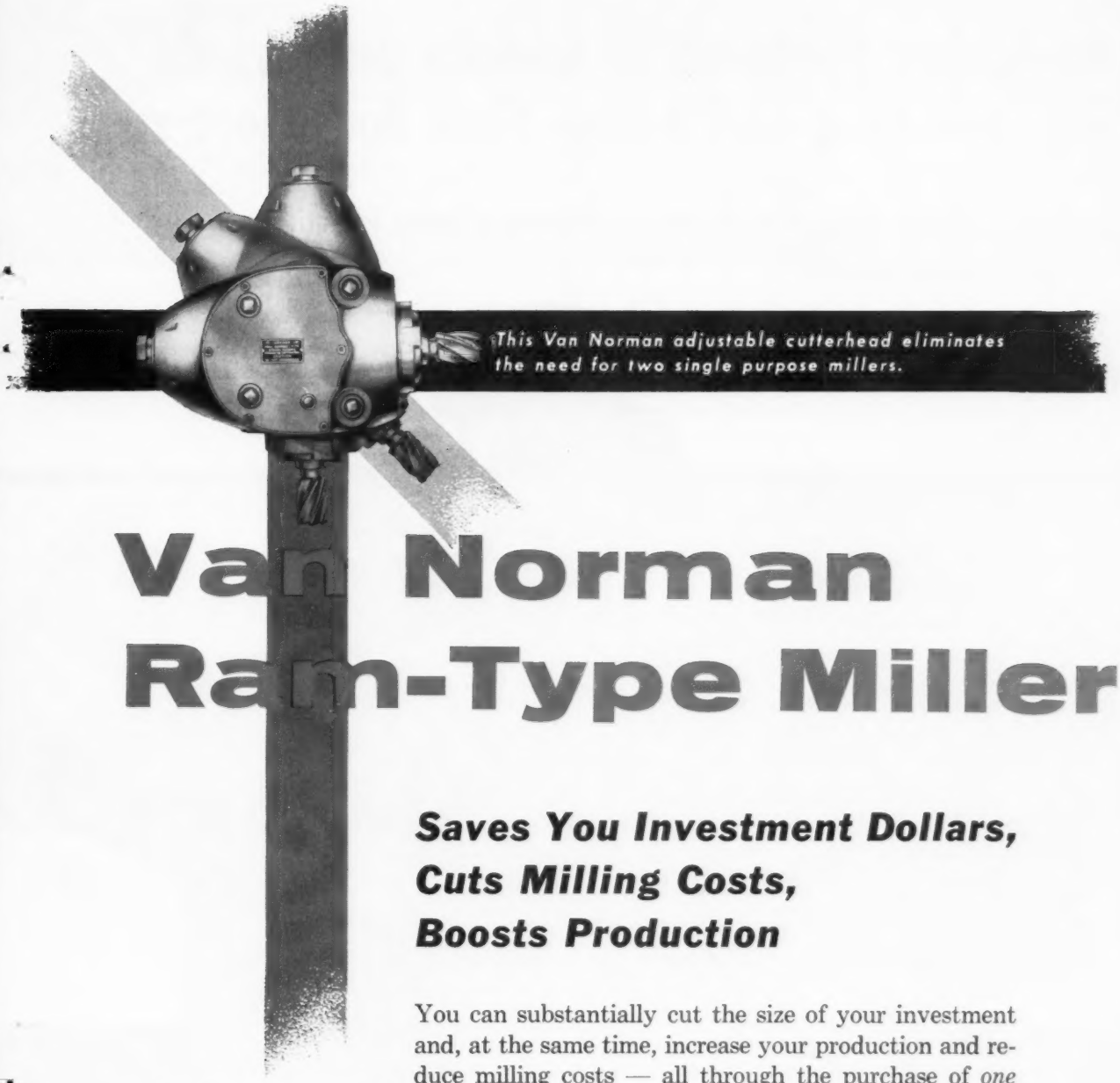
One

The Van Norman
38 MEA Ram-Type
Miller
Table Size: 64" x 14"
Spindle Cutterhead
Motor: 10 HP

VAN NORMAN MACHINE

A DIVISION OF VAN NORMAN INDUSTRIES, INC.

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.



This Van Norman adjustable cutterhead eliminates the need for two single purpose millers.

Van Norman Ram-Type Miller

Saves You Investment Dollars, Cuts Milling Costs, Boosts Production

You can substantially cut the size of your investment and, at the same time, increase your production and reduce milling costs — all through the purchase of *one* Van Norman Ram-Type Miller.

Available for all types of work, Van Norman Ram-Type Millers permit horizontal, vertical and angular milling without attachment — they reduce idle machine and operator time.

Get complete details on the Van Norman 38 MEA, or on any of the many Van Norman Ram-Type Millers. Write, wire or telephone for catalog.

COMPANY

SPRINGFIELD 7, MASSACHUSETTS

Don't wait . . . for extra profit install a Van Norman machine now! They are available in many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate up to 10 years. Conditional Sales Contracts not available to Export.

For more information fill in page number on Inquiry Card, on page 241

Exclusive features of Landis universals cut grinding and setup time for short runs

. . . fully universal grinder saves time on precision grinding operations

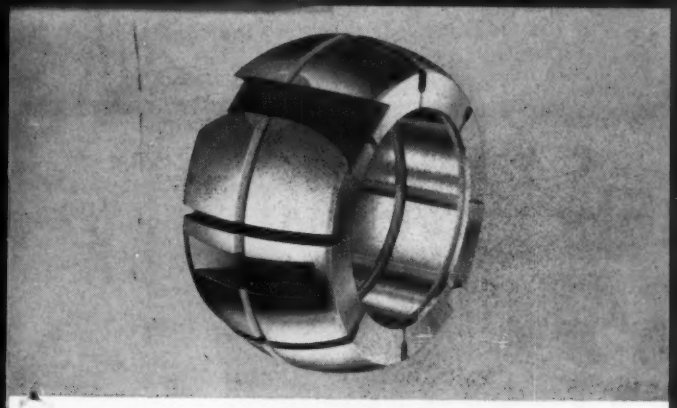
. . . speeds setup changes

Landis 12" x 36" Type CH Precision Universal Grinder

LANDIS

precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

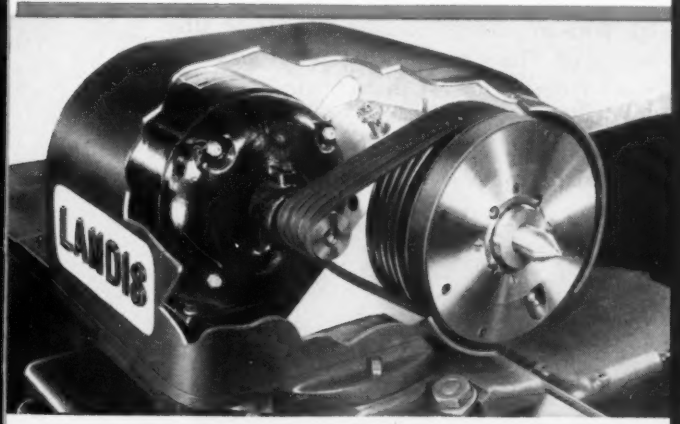


1 **Landis Microsphere Bearings**

Closest running clearance of any type spindle bearing gives finest finishes.

2 **Eye-Level Wheel Feed**

Operator can see both grinding operation and handwheel graduations.



3 **Variable Speed Headstock**

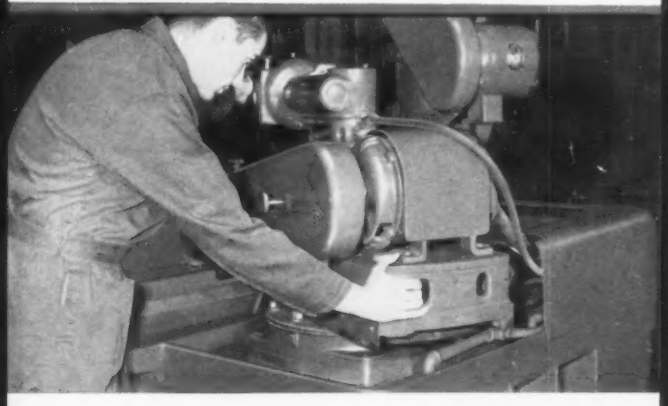
Low, compact headstock. Only two revolving parts. Speed regulated by a rheostat control.

4 **Swinging Type Internal Grinding Fixture**

Quick changeover, accurate and rigid. No exposed belts. Swings up out of the way.

5 **Rapid Hydraulic Wheel Positioning**

Saves setup time by rapidly advancing or retracting wheelhead. (Extra equipment.)



6 **Universal Wheelhead Swivel**

Easy hand swiveling of wheelhead—without bars—saves time when setups are frequent.

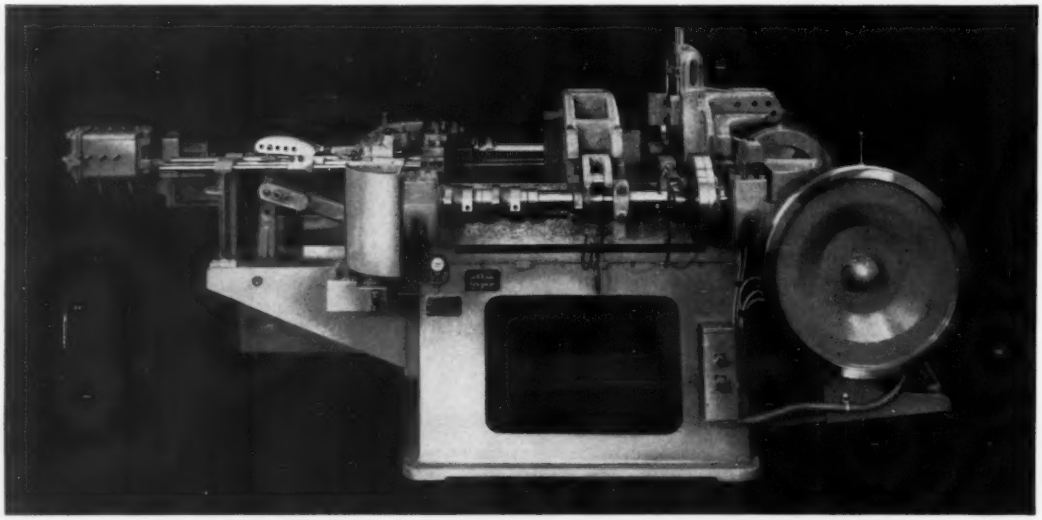
INCREASE PROFIT MARGIN ON FORMED STAMPINGS WITH U.S. MULTI-SLIDES®

Reduce your costs and increase your profit potential! The elimination of secondary operations and handlings is one of the best ways in which you can achieve reduced costs. It is therefore important to produce parts, wherever possible, complete in one machine.

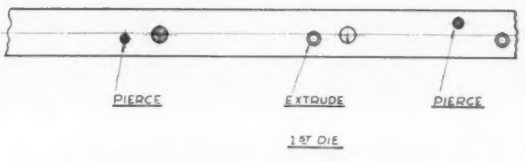
The U. S. Multi-Slide, through a combination of built-in motions, allows for the designing of tools to fabricate precision formed metal stampings without secondary handlings.

For example, the automotive component shown above is produced complete, without secondary operations, in the No. 33 U. S. Multi-Slide Machine of the type illustrated below. The drawings below indicate the sequence of stages in the dies and forming positions. Note the two-level forming position used to complete the piece after cutting off. This automotive part is but one of the many types of formed metal stampings which can be produced complete in the U. S. Multi-Slide.

Standard equipment on the Multi-Slide in-



Above: The No. 33 U. S. Multi-Slide used, with two rams and appropriate tooling, to produce the formed stamping illustrated on the facing page. This size machine has a capacity for material up to 2 1/2" wide by 3/32" thick, with feed length adjustable up to 12 1/2".



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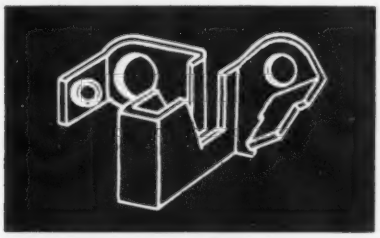


cludes: ram action for cutting, piercing, trimming, embossing, etc.; a four-slide forming position, and a vertical movement for stripping and transferring. Since these movements are an integral part of the machine equipment, it is not necessary to incorporate complicated movements into the dies themselves. These features make the U. S. Multi-Slide extremely versatile in the automatic, high-speed production of all types of formed metal stampings.

Investigate! Ask for a copy of Bulletin 15-M, or send us part drawings or samples for our recommendations.

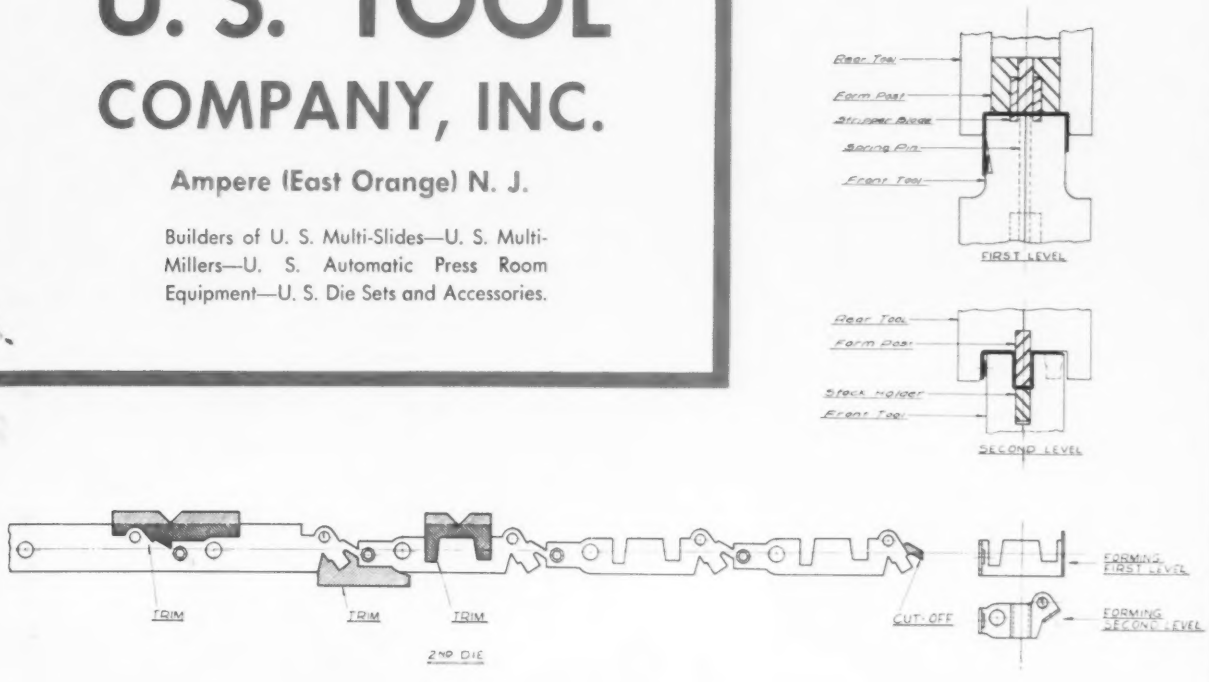
U. S. TOOL COMPANY, INC.

Ampere (East Orange) N. J.

Builders of U. S. Multi-Slides—U. S. Multi-Millers—U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories.

SEQUENCE STRIP SHOWS OPERATIONS PERFORMED

The drawing below shows the sequence of stages in the dies and forming positions of the U. S. Multi-Slide to produce the automotive component illustrated above. Observe the two-level forming position used to complete the piece after cutting off.



GIDDINGS & LEWIS

GIDDINGS & LEWIS

(MODEL 1210-FUAR)

World's largest horizontal boring, drilling and milling machine with underarm spindle support

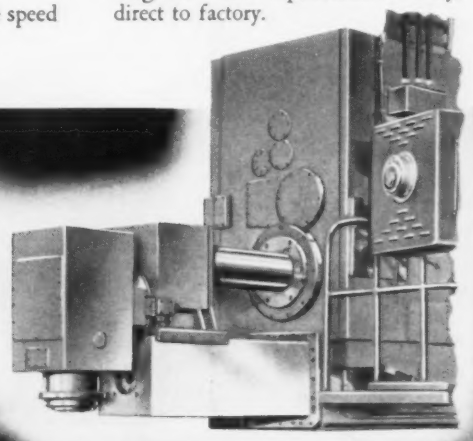
How many times have you said: "We could bore, face and mill *huge workpieces* faster, better and at a profit if we only had a bigger horizontal." The answer to this problem is the new G&L Model 1210-FUAR (floor-type) with 10-inch diameter spindle and 18-inch square underarm — *the world's largest.*

Incorporated in the Model 1210-FUAR are many of the outstanding and proven design features of G&L's broad line of horizontal machines. Weighing over 220 tons, the 1210-FUAR is 27-ft. high. All welded steel construction contributes to extreme machine rigidity. The 42-ton headstock and underarm are arranged for mounting a spindle support and a 2-ton, 90° angular milling attachment.

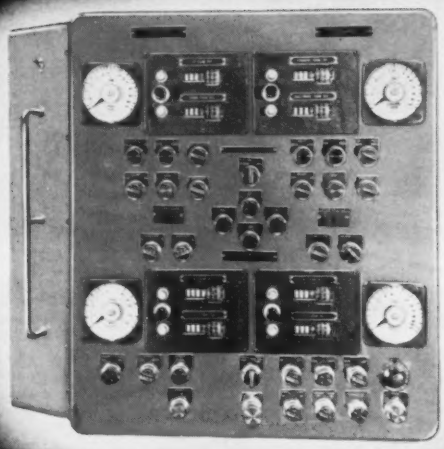
The 1210-FUAR has an overall spindle speed range of 1.5 to 400 rpm . . . two ranges of .002 to .5 ipm and .5 to 120 ipm feed and traverse to spindle and underarm . . . milling feeds to column and headstock from .5 to 120 ipm over four gear ranges. Other operating features include: independent control of headstock and column, remote feed range selection, readout measuring device (optional) for positioning headstock, spindle underarm and column to .001"

G&L's 1200 Series horizontals are available with 10, 12 and 14-inch diameter spindles, powered by 100 or 150-hp motors. They can be furnished with vertical headstock and horizontal column travel to any desired specifications.

For complete specifications, contact your Giddings & Lewis representative today, or write direct to factory.



2-ton 90° angular milling attachment



Power-operated push button pendant control

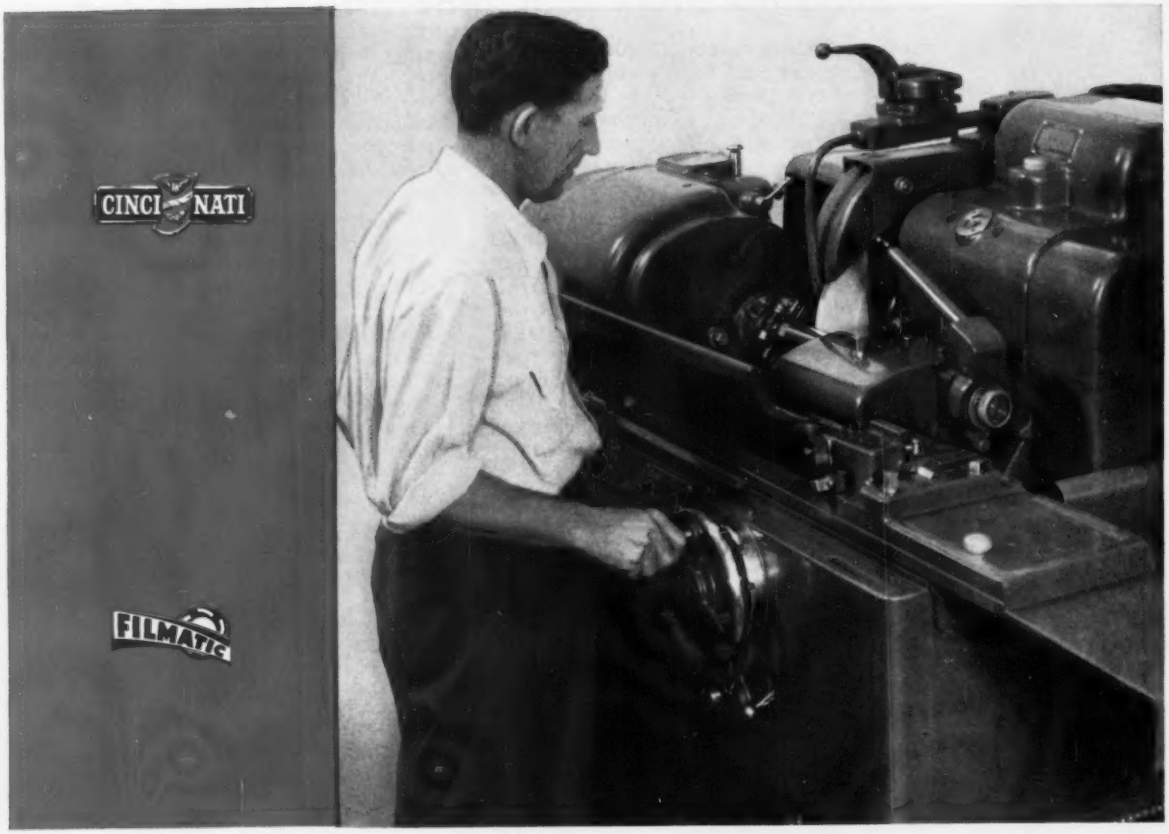
G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN G-74

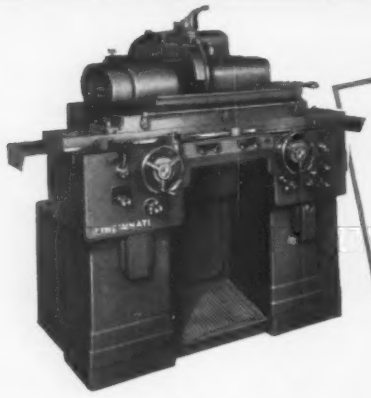
Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Milling Machines.

Here's the Point . .

. . . your standard and special tooling high precision work, from the point on a textile machine part to small armature shafts, get the most economical grind on CINCINNATI® FILMATIC 4" Plain Hydraulic Grinders. May we tell you more? Catalog No. G-551-4 contains complete data; write for a copy.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO





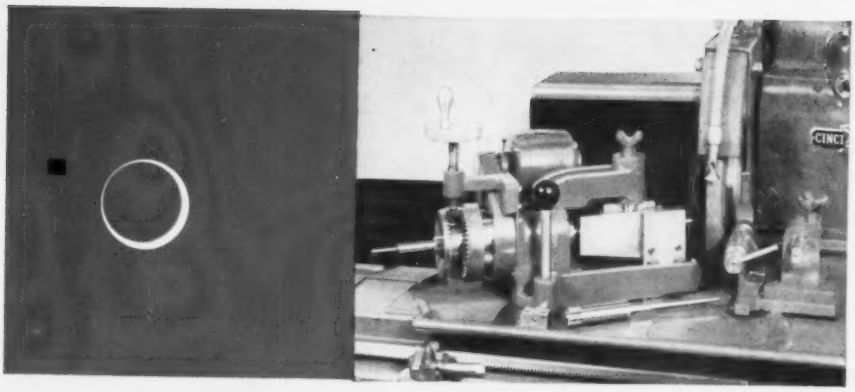
CINCINNATI FILMATIC 4" PLAIN HYDRAULIC GRINDING MACHINE
Catalog No. G-551-4
Brief Specs. in Sweets

Master roller gages are ground to accuracies of 10 millionths in roundness and size on the CINCINNATI FILMATIC 4" Plain illustrated here. Surface finish within 2 micro-inches. Of course this machine is equipped with a number of extra features to enable it to produce ultra-precision work of this type. Compared to the previous machine and method, tolerances have been cut in half and production is about seven times greater.

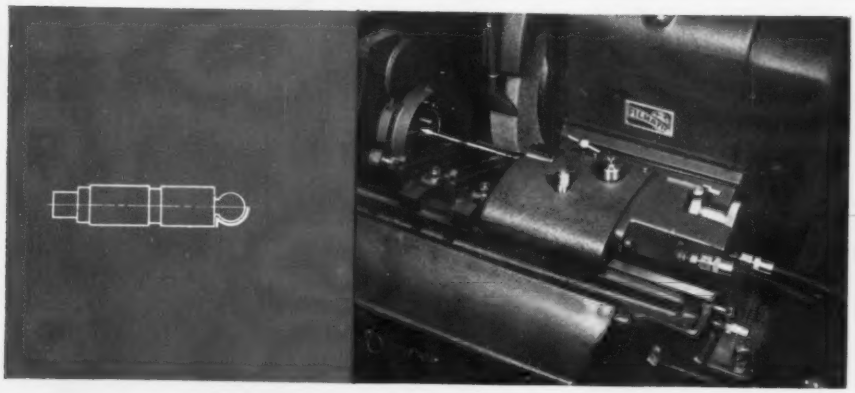
CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE

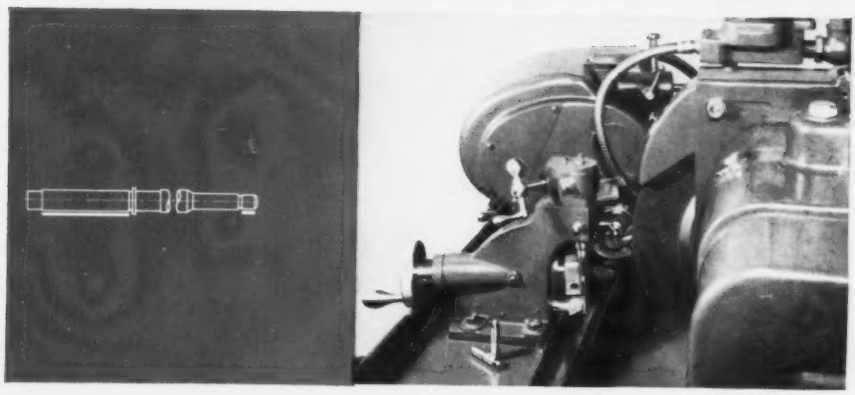
For more information fill in page number on Inquiry Card, on page 241



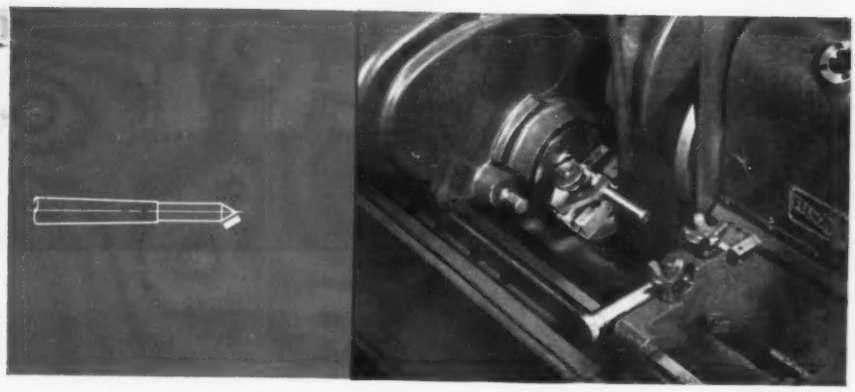
Center angle and point radius are ground concentric with bearing diameters on textile machine parts. This Cincinnati engineered equipment illustrates how simply an unusual production job can be tooled up on a CINCINNATI FILMATIC 4" Plain Hydraulic Grinder. Conventional swivel table, headstock and footstock have been omitted and replaced by a special fixture.



Two diameters are precision ground on armature shafts in two setups, at the rate of 200 per hour per diameter. To reduce operator fatigue while maintaining a high rate of production, the CINCINNATI FILMATIC 4" Plain Hydraulic Grinder for this job is equipped with automatic infeed, hydraulic footstock and work cradles.

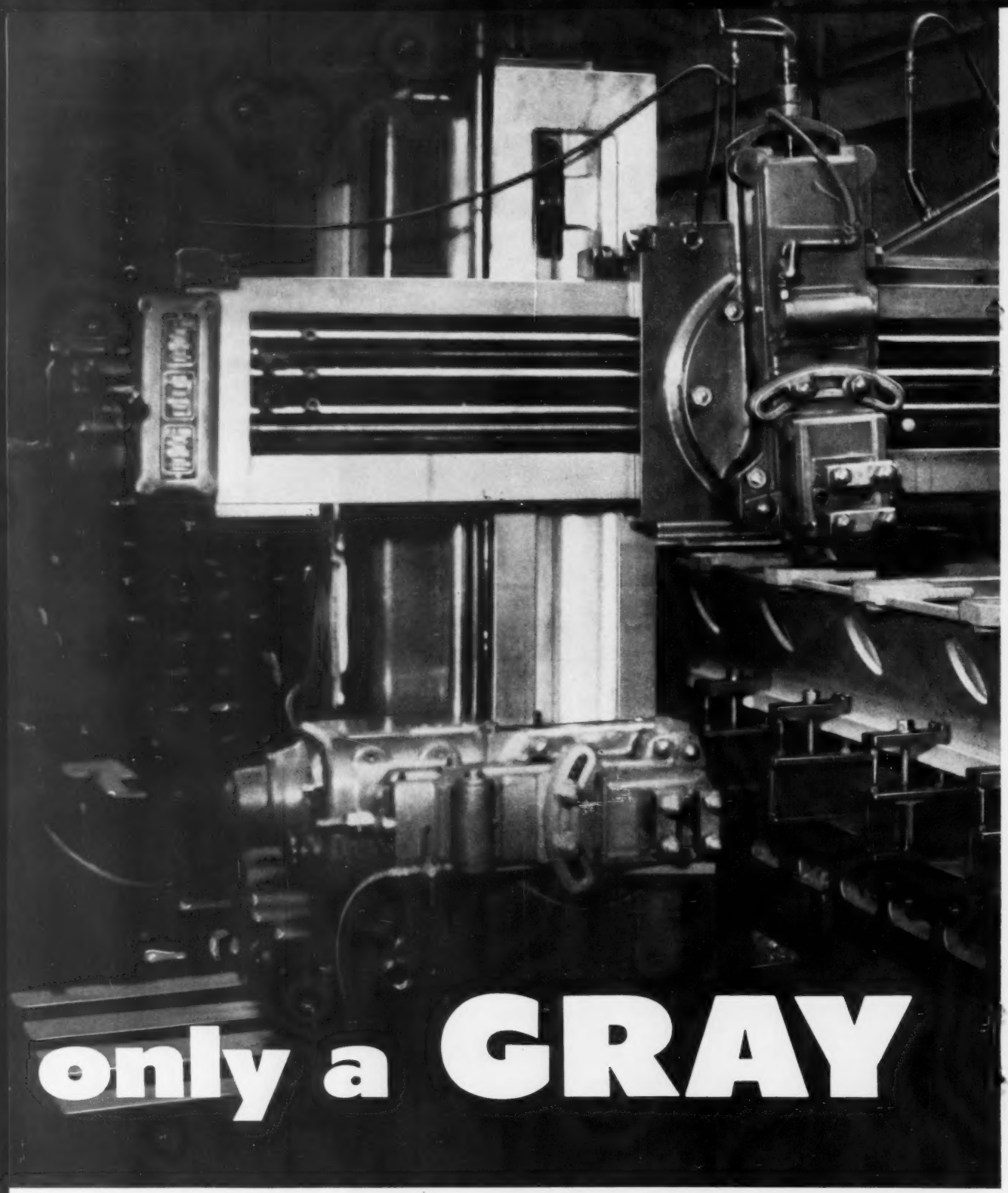


Ball end and shoulder are ground in one chucking on a CINCINNATI FILMATIC 4" Plain Hydraulic Grinder. Unique tooling for this job includes combination radius and angular truing attachment, and table with an angular bearing section for live spindle headstock featuring a lever operated draw-in collet attachment.



.048" eccentric diameter ground from the solid. The CINCINNATI FILMATIC 4" Plain Hydraulic Grinder at the left easily handles this heavy stock removal job. Equipment is practically standard with the exception of the work holding fixture and a special table type truing attachment.

GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES



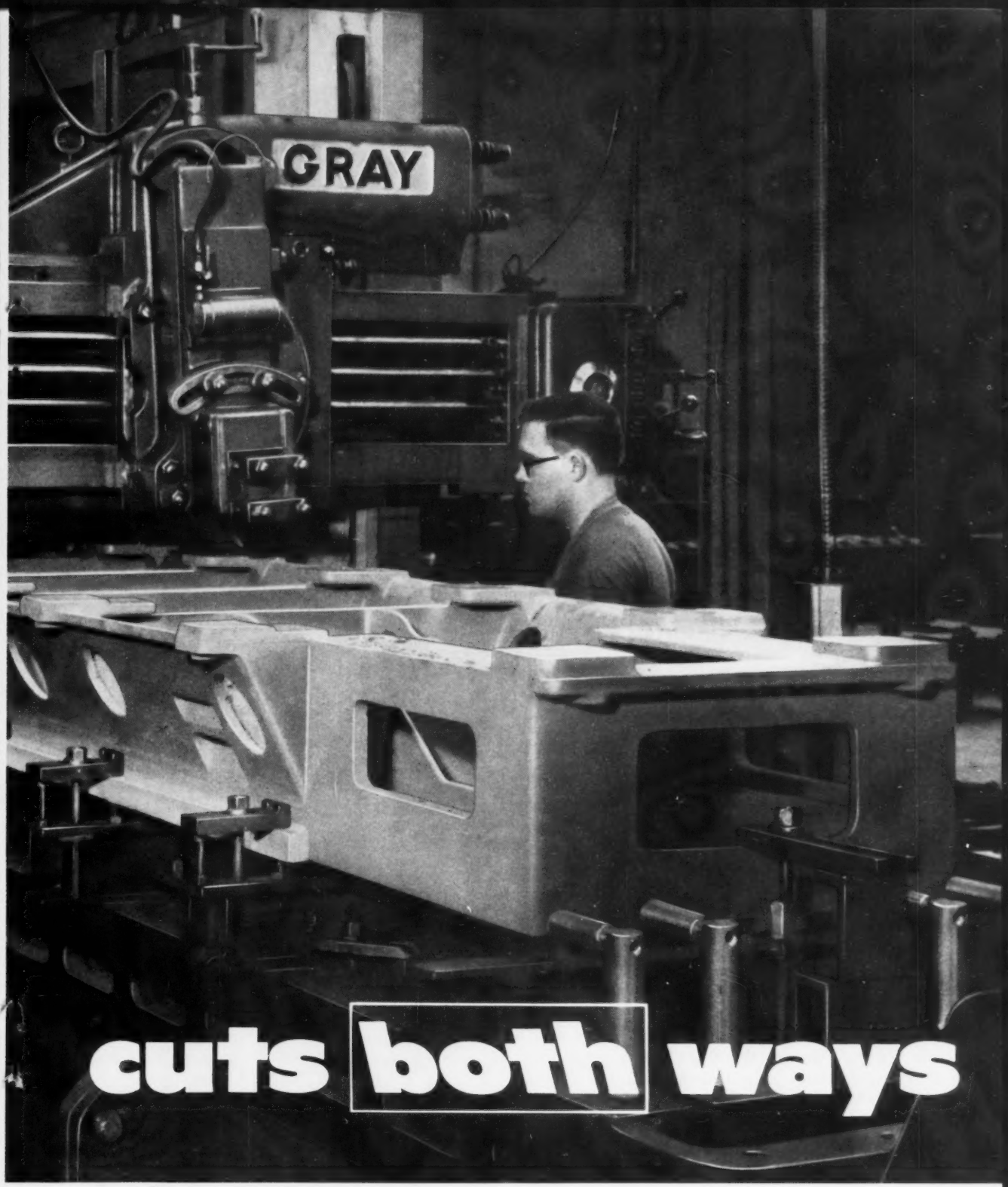
only a GRAY

Cuts going—cuts coming . . . that's "double-cutting" with the GRAY Universal Planer. At Textile Machine Works, Reading, Pennsylvania, this new GRAY is pictured double-cut carbide planing a Tricot Machine Base. Former floor to floor time of 62 hours has been slashed to 12 hours by the enormous productive potential of the new GRAY that cuts both ways.

The G. A. GRAY Co., Cincinnati, Ohio.

heavy-duty planing

The Gray Universal is the world's most powerful planer available for conventional planing. Its rigidity and speed are ideally suited for modern carbide cutting.



cuts both ways

double-cutting

The flick of a lever, the touch of a button permits double-cutting. Elimination of the idle stroke insures the world's most efficient flat surface machining. Only simple carbide tools are required.

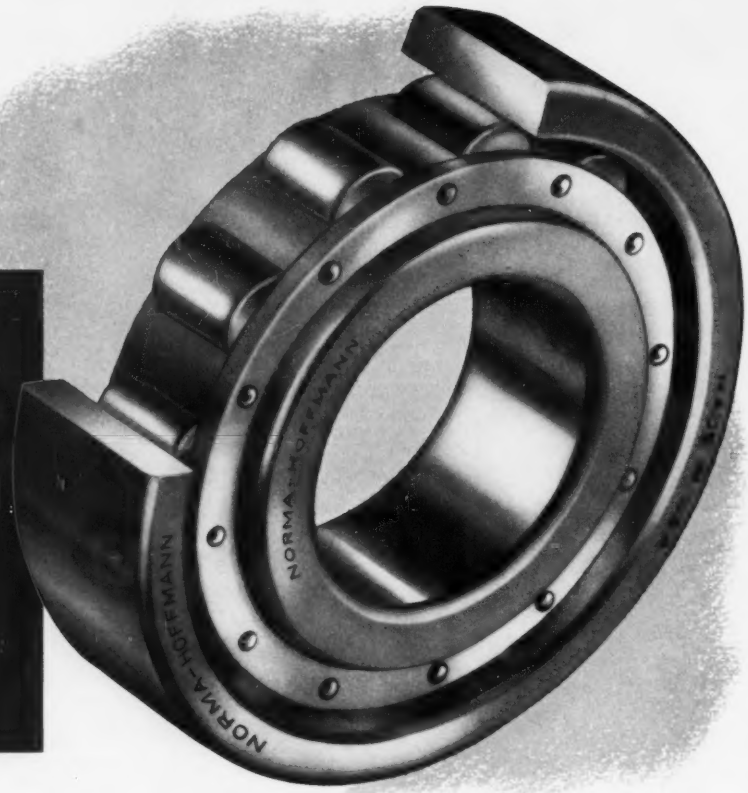
triple-cutting

Rough and rough-finish plane at the same time. Rough by double-cut planing and simultaneously rough-finish with a single point tool. Then finish plane without a tool change.

cross planing

Eliminates extra settings by cross planing the occasional keyways, chamfered corners, and other troublesome small cross surfaces that formerly added hours to your set-up time.

For Greater Load Carrying Capacity in Minimum Space...

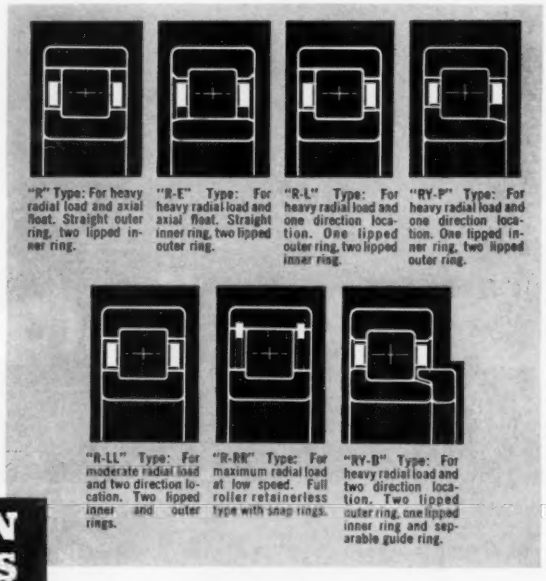


NORMA-HOFFMANN *Precision* Roller Bearings

If your bearings must operate under such severe conditions as high speeds, heavy loads, temporary overloads, shock or vibration, then *Norma-Hoffmann* Precision Roller Bearings are your solution. Available in a wide range of both metric and inch sizes from 10 millimeter bore upward.

Compare These Advantages

1. **Extra Heavy Radial Load Capacity Plus Resistance to Shock and Vibration.**
2. **Lower Friction Coefficient under Heavy Load.**
3. **Speed Ability Equal to Any Ball Bearing, Size for Size.**
4. **Shaft Expansion Allowed without Looseness in Housing.**
5. **Weight Saving Possible by Use of Smaller Sizes or Lighter Series.**
6. **Interchangeable with Single Row Metric Ball Bearings.**



"R" Type: For heavy radial load and axial float. Straight outer ring, two lipped inner ring.

"R-E" Type: For heavy radial load and axial float. Straight inner ring, two lipped outer ring.

"R-L" Type: For heavy radial load and one direction location. One lipped outer ring, two lipped inner ring.

"RY-P" Type: For heavy radial load and one direction location. One lipped inner ring, two lipped outer ring.

"R-LL" Type: For moderate radial load and two direction location. Two lipped inner and outer rings.

"R-RR" Type: For maximum radial load at low speed. Full roller retainerless type with snap rings.

"RY-B" Type: For heavy radial load and two direction location. Two lipped outer ring, one lipped inner ring and separable guide ring.

NORMA-HOFFMANN *Precision* **BEARINGS**
BALL • ROLLER • THRUST

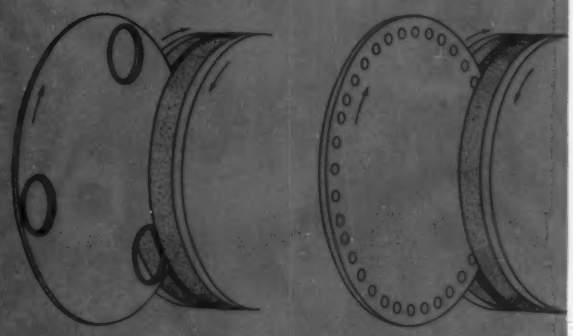
NORMA-HOFFMANN BEARINGS CORPORATION
Founded in 1911 • STAMFORD, CONNECTICUT

FIELD OFFICES: Atlanta • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Kansas City • Los Angeles • Philadelphia • San Francisco • Seattle

For more information fill in page number on Inquiry Card, on page 241

Bearing manufacturer grinds large and small parts with new Gardner Disc Grinder

grinds TWO parallel surfaces in ONE operation



3 station rotary carrier with face cutting cycle

Continuously rotating carrier for small parts

2H30 Double Spindle Precision Disc Grinder

production data:	Races	Rollers
Size of workpiece	.504" Thick 6.508" O.D. 6.093" I.D.	1.25" long x 1.126" dia.
Production Rate: pieces per hour	100	600
Stock Removal: max. over-all	.010"-.012" per cut	.008"-.010"
Tolerances:		
Flatness and parallelism	.0002"	.0002"
Uniformity	.00015"	.001"
Squareness TIR	—	.0002"

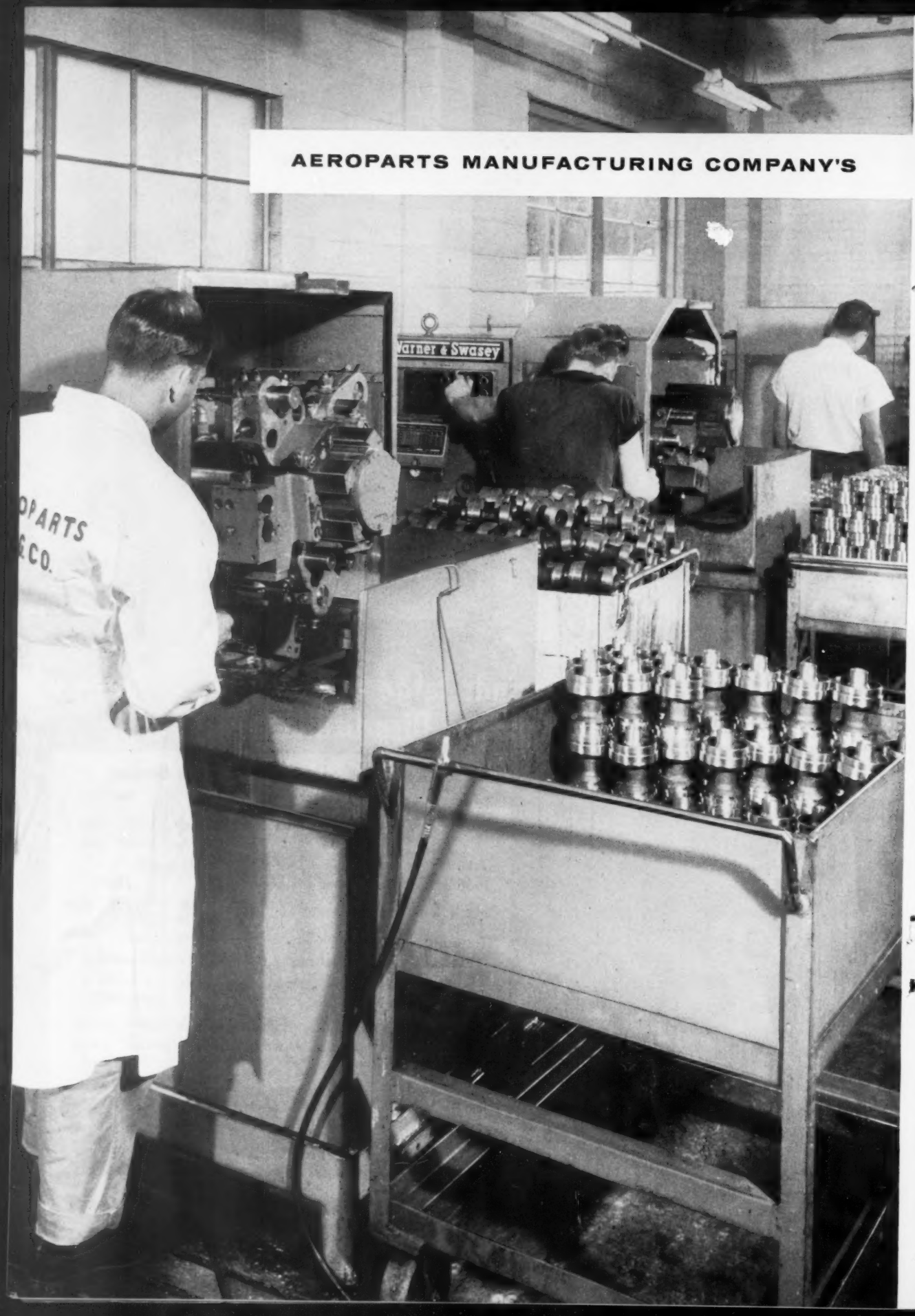
. . . User reports continue to stress performance value of 2H30 . . . interchangeable work carriers permit quick change from job to job.

GARDNER

precision disc grinders

BELOIT, WISCONSIN

AEROPARTS MANUFACTURING COMPANY'S



RECIPE FOR SUCCESS

Take on the Tough jobs put them on a Warner & Swasey

R. E. Radford started his company in Tulsa, Oklahoma, in 1943 with a $350.00 investment. Today, his new 40-man plant does sub-contracting on a national scale with a reputation for price and quality.

But, success was not immediate. Even as late as 1952, business prospects looked dim. Then, a man's resourcefulness plus a new kind of machine teamed up to start a literal chain reaction of success. Here's how it happened.

Radford had the idea that there was a profitable future in taking on the tough jobs that were not desirable to other companies. He also had faith to back his convictions. Now all he needed was the right machine to do the job . . . his search was a short one . . . the new Warner & Swasey 1 AC looked like the machine.

This new single spindle chucker allowed him to expand from his former policy of making screw machine parts to one involving larger, more complicated work . . . permitted him to run short cycle jobs at close tolerances of .001" and less . . . hold micro-inch finishes down to 20 RMS . . . make full use of the machine's late cross slide, flexible tooling characteristics. The dependability of this machine impressed him as much as did its productivity.

These advantages, and others that soon reflected themselves in increased values rendered to his customers, brought more business. So, another Warner & Swasey 1 AC was installed in 1954 and a third in 1955.

Today, men and management at Aeroparts maintain their high regard for their Warner & Swaseys. And in "Tex" Radford's words, "These machines were integral in the growth of this company!"

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS

. . . WITH A WARNER & SWASEY

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

For more information fill in page number on Inquiry Card, on page 241

FOOTBURT
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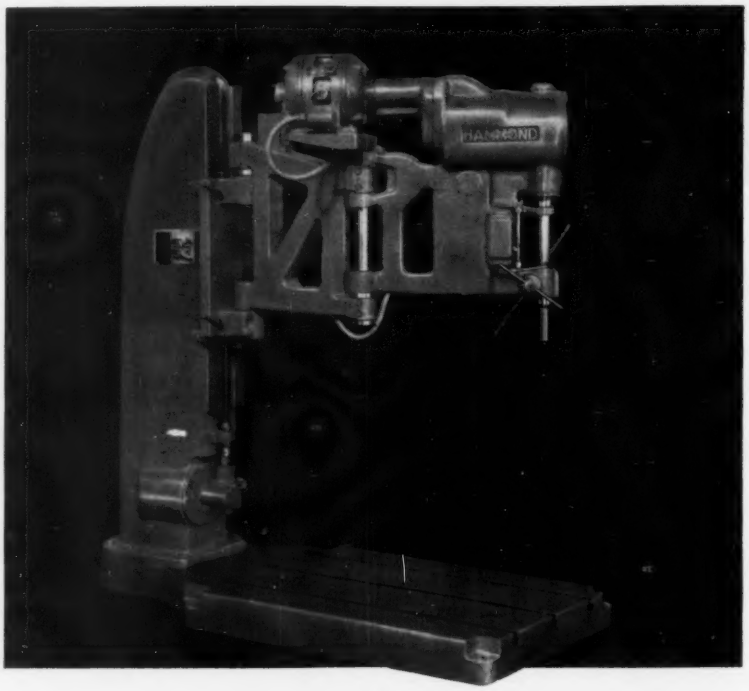
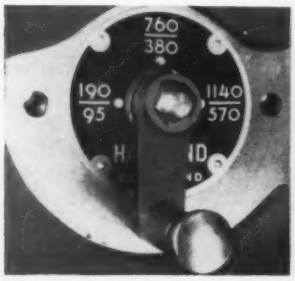
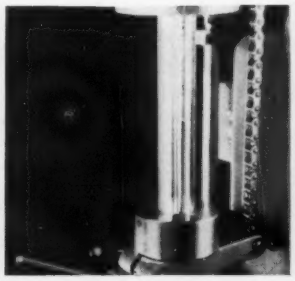


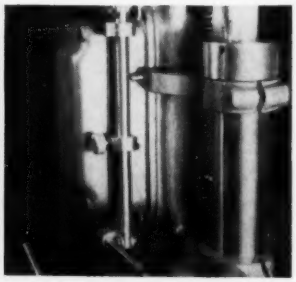
for *faster* radial drilling and tapping

■ Hammond Radial Drilling and Tapping Machines may be spotted in the production line for drilling, tapping or reaming. With its unique Bracket Type construction the spindle can be swung quickly from hole to hole. Six Quick Speed Changes are instantly available and the Hammond Tapping Reverse is very fast and convenient to operate.

THE FOOTE-BURT COMPANY • **Cleveland 8, Ohio** • Detroit Office: General Motors Building







Engineered for production

FOOTBURT

MACHINE TOOLS

For more information fill in page number on Inquiry Card, on page 241

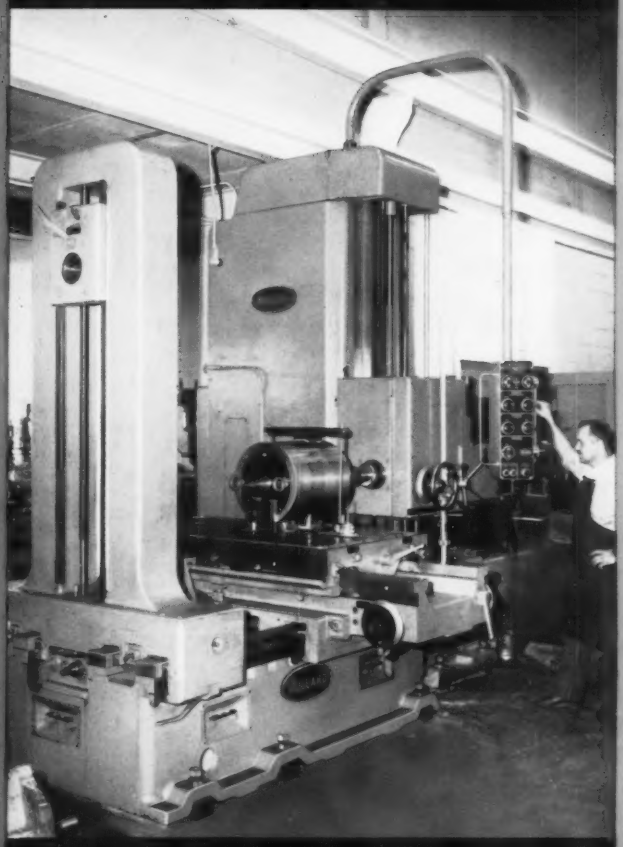
"The only Horizontal Boring Mill of modern design today is the

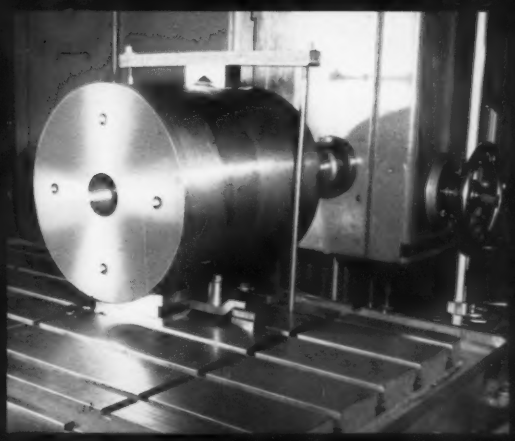
BULLARD

H.B.M., Model 75"

So says Mr. Arthur D. McDonald, President of E & M Enterprises, Inc. of Middleport, New York, builders of special machinery and tools for industry.

"There is no comparison" continues Mr. McDonald, "between our previous boring mill and the Bullard Model 75 — it is more accurate, faster, has more capacity, is simple to operate, has greater rigidity — all of which add up to more weekly production of . . . precision parts". . .



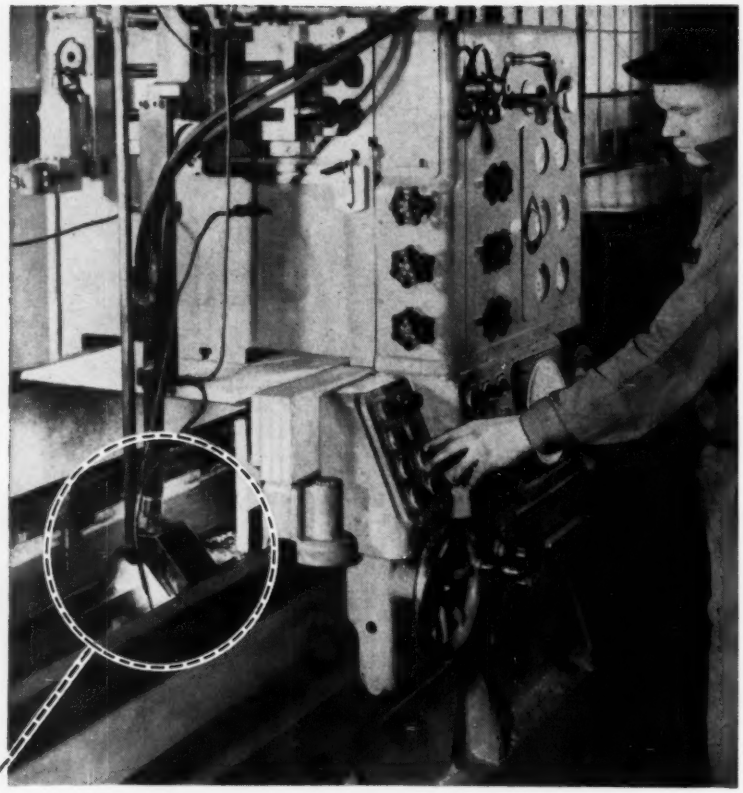


How about You?

Are you getting these same advantages in your manufacturing — if not, phone your nearest Bullard Sales Office for complete catalog or write

THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT

HIGH SPEED FLAME-HARDENING



Cross-section view shows uniform depth of hardened surface.

SPECIAL MACHINE UPS LIFE OF GRAPHITIC STEEL PARTS

LINDE engineers have assisted Cincinnati Steel Treating Company in developing a flame hardening machine which increases service life of 16 ft. long, graphitic carbon steel lathe ways . . . Development of this automatic, high speed machine is another example of how LINDE Service Engineers are helping LINDE's customers up production speed and unit quality through co-operative research engineering.

With this new machine, a lathe way to be treated is placed on a magnetic chuck in a water filled channel. Flame-hardening heads and control mechanism move at predetermined speeds along the part. After it cools, the lathe way is placed in a refrigerator for 24 hours which stabilizes the steel, and brings its case hardness to a minimum of 60 Rockwell "C" scale.

The benefits of LINDE's research, engineering, and over 40 years of accumulated know-how stand behind each of its customers to help them solve production problems. Get these "plus-values" which LINDE offers—it pays you to do business with LINDE.

Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities
In Canada: LINDE AIR PRODUCTS COMPANY
Division of Union Carbide Canada Limited, Toronto

Linde
Trade-Mark

The term "Linde" is a registered trade-mark of Union Carbide and Carbon Corporation.

For more information fill in page number on Inquiry Card, on page 241

Background For Perfection

Gages do "tell the story" of perfect threads. But back of *that* story you will find holes perfectly drilled, taps properly selected and correctly used, and engineering services freely given.

When tooling any threading job, get the whole story — specify GREENFIELD cutting Tools *and* GAGES.

Write for new Greenfield Handbook —"Facts About Taps and Tapping."

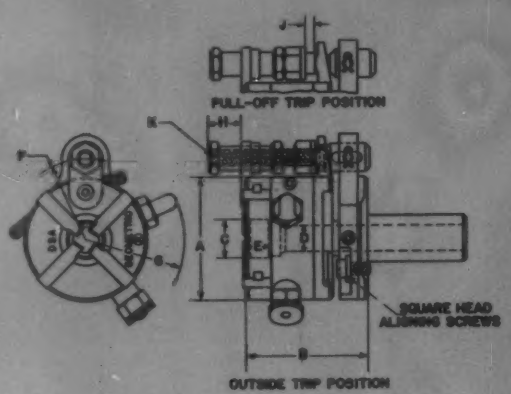
GREENFIELD TAP and DIE CORPORATION

Greenfield, Massachusetts

Making the best...BETTER

NEW Geometric Convertible self-opening die head with aligning shank

1. *Ease of assembly and disassembly.*
2. *Improved driving construction for freer and smoother operation.*
3. *Improved locking bolt and segment providing greater wear life.*
4. *Tongue and groove drive between cam spring plate and skeleton.*
5. *More rugged construction of small parts — new and heavier stop plunger, larger adjusting screws (Hollow Hex), heavier tripping mechanism, larger cam spring plate screws — without increase in size or weight of die head.*
6. *Flatted construction of backpart and shank (permitting the die head to be installed as close to the turret as possible without interference).*
7. *Better interchangeability of parts.*
8. *Present DS chasers interchange in New "DSA" Model.*



There is no better Die Head available for use on Brown and Sharpe and other small screw machines of either the automatic or hand type than the *NEW* Geometric convertible self-opening style DSA Die Head.

The *NEW* DSA comes with an aligning shank which permits adjustment for machine misalignment. It is equipped, also, with both Outside Trip for short length, fine pitch shoulder threading and a Pull-Off Trip for threading lengths providing ample chaser engagement for tripping. Conversion from one trip to the other is quick and simple. The DSA is especially recommended for cutting fine pitch threads of short lengths.

An outstanding Die Head that is really *rugged, requires minimum attention* and is *easier to adjust*, the DSA now joins the Geometric family of the best in precision threading tools.

SPECIFICATIONS — STYLE DSA *For the present the DSA is available in ¾" size*

Style and Size Inches	MACHINE USED ON	CAPACITY Str. Threads Dia.	§ Lgt.	Coarsest Pitch	Std. Pipe	Code Word	A	B	C	D	E	F	G	H	J	K	Standard Shanks† Dia.	Lgt.	Bore	Max. Shanks Without Bushings Dia.	Lgt.	Chasers	Net Wt. Std. Shk. for B. & S. Mach.
DSA ⅝	00 and 00G-B. & S. Auto. 0-B. & S. Wire Feed & Hand Cleveland S.S.	⅛ to ⅝	1¼	18	None	Lesab Lesac Lesad Lesae	1⅝	1⅜	33/64	1½2	1½2	1¼	1¼	Max. 1½2 Min. ⅝	Max. ⅛ Min. 0	#12-28 N.F.	⅝ ¾ ⅞ 1⅛	1¼ 6 6 6	½ Solid Solid Solid	⅜ 1¼	1¼ 6	4	13 oz.

§ Length that can be cut when shank is solid.
† Special Shanks furnished at extra cost.

WRITE TODAY FOR FURTHER INFORMATION OR SEE YOUR LOCAL INDUSTRIAL DISTRIBUTOR

GEOMETRIC TOOL COMPANY DIVISION
GREENFIELD TAP AND DIE CORPORATION
NEW HAVEN 15, CONNECTICUT

If you're in a hole . . .

BECAUSE OF GRINDING WHEEL PROBLEMS, there's an easy way to get back on top of the situation. Switch to CINCINNATI (PD)° WHEELS. *Now* CINCINNATI Grinding Wheels offer POSITIVE DUPLICATION—a remarkable achievement in precision manufacturing and quality control that can *save you money . . . and* increase your production.

It doesn't take any digging to find out *why* everybody's talking about (PD) WHEELS. Through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

° Trade Mark Reg. U.S. Pat. Off.

So, if you want back on solid ground again, see your CINCINNATI Grinding Wheels Distributor. He'll be glad to explain how (PD) WHEELS can save you money and increase production. Or, contact us direct and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

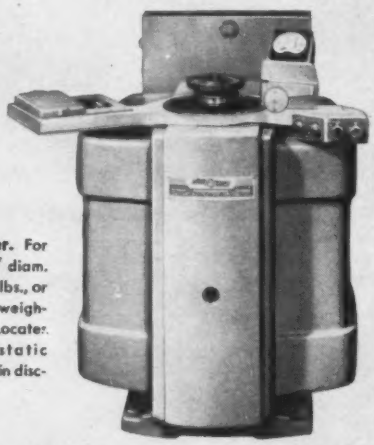
Remember—*only* CINCINNATI Grinding Wheels give you

(PD) POSITIVE DUPLICATION.

CINCINNATI° *Grinding Wheels*

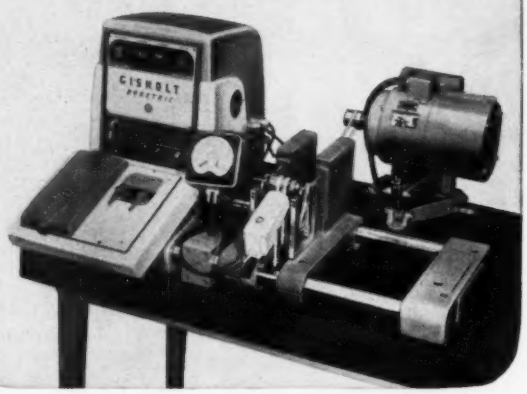
A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

GISHOLT takes the ...cuts time

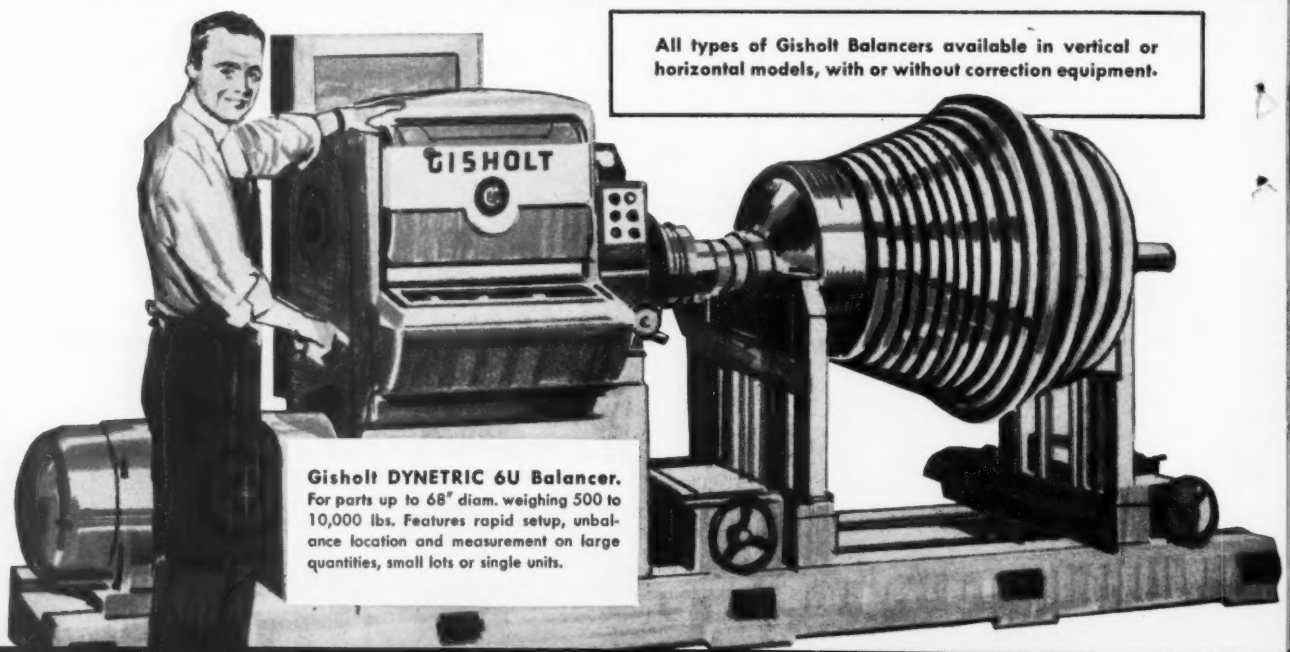


Gisholt 1SV1 Balancer. For parts up to 11½" diam. weighing 1 to 15 lbs., or up to 17½" diam. weighing 2 to 50 lbs. Locates and measures static (force) unbalance in disc-like parts.

Gisholt OSB Bench Balancer. For parts up to 6" diam. weighing 0.25 to 5 lbs. Small parts readily handled, with location and amount of unbalance in each of two selected planes accurately determined in 15 seconds or less.



All types of Gisholt Balancers available in vertical or horizontal models, with or without correction equipment.

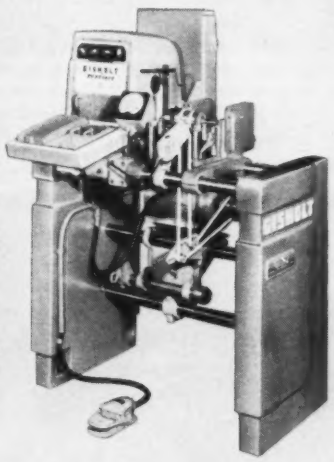


Gisholt DYNETRIC 6U Balancer. For parts up to 68" diam. weighing 500 to 10,000 lbs. Features rapid setup, unbalance location and measurement on large quantities, small lots or single units.

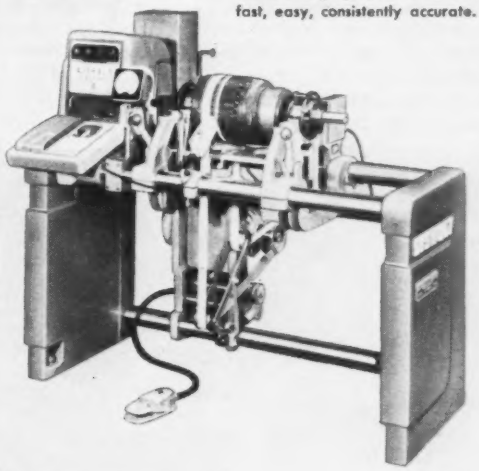
guesswork out of balancing and costs, too!

MASTERLINE GISHOLT SINCE 1887

Gisholt 1S Balancer. For parts up to 12" diam. weighing 1 to 30 lbs. Locates and measures either force or moment unbalance effects, indicating amount of correction in units most practical for part.



Gisholt 3S Balancer. For parts up to 24" diam. weighing 15 to 300 lbs. Gisholt Balancers eliminate charts and graphs, make balancing fast, easy, consistently accurate.



IN A MATTER OF SECONDS, a Gisholt Balancer locates and measures vibratory movements in either one or two planes (force or moment), and tells your operator precisely where and how much correction to make to balance the part.

By simply reading the Amount Meter, he knows instantly how much solder or how many washers to add, or how deep to drill, etc. There is no computation, no charts or graphs because Gisholt Balancers tell the story directly—and they tell it in terms of the actual correction method employed.

How is it done? Through electrical networks, providing the necessary amplification for precise readings... and eliminating guesswork by separating and isolating unbalance effects, for maximum accuracy and ease of correction on all types of work.

What will Gisholt Balancing mean in your own operations? Just this: you'll balance more parts per hour—to highest possible standards at lowest possible costs.

Whether you plan to balance parts weighing only a few ounces to 150 tons...your Gisholt Representative can show you the better way of doing it with Gisholt Balancers. Call him today!

DYNETRIC BALANCERS (GISHOLT) DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION "DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

WRITE TODAY for 36-page illustrated booklet "Balancing Machines," analyzing problems of balancing rotating parts.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

7 great lapping machines for your profit-boosting

"TOUCH of GOLD"

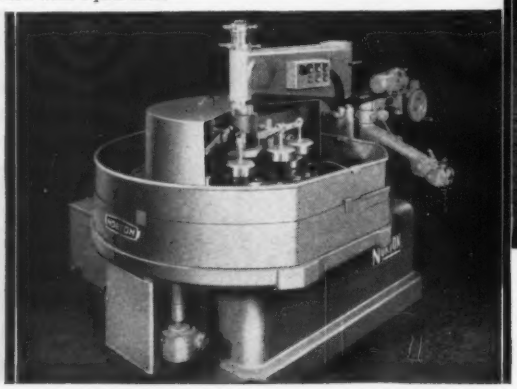
If you are performing single or parallel face flat lapping operations you'll get real profit-boosting qualities from the ability of these machines to improve your product quality — shorten production time — lower your lapping costs. In other words — from their ability to give you the "Touch of Gold".

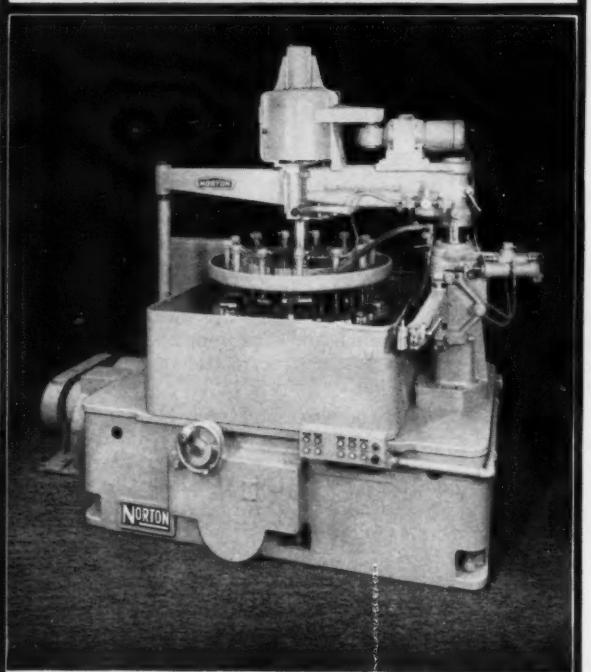
With NORTON HYPROLAP® machines you'll lap fast — and get clean work on which you can do further machining without cleaning operations — because their bonded abrasive laps leave your parts free of imbedded grit. The hydraulically operated truing devices on these machines provide additional advantages in assuring truth of lap face — plus the convenient means of quickly changing lapping action by rough or fine truing of the lap by simple adjustment of the speed of the truing arm.

For operations requiring cast iron laps, you will get continuing high investment return — and steady, low cost production from the #16-FC and #28 Lapping Machines — because of their simplicity of operation — and outstanding durability. They'll operate steadily for you with minimum attention or maintenance — hour after hour — day after day.

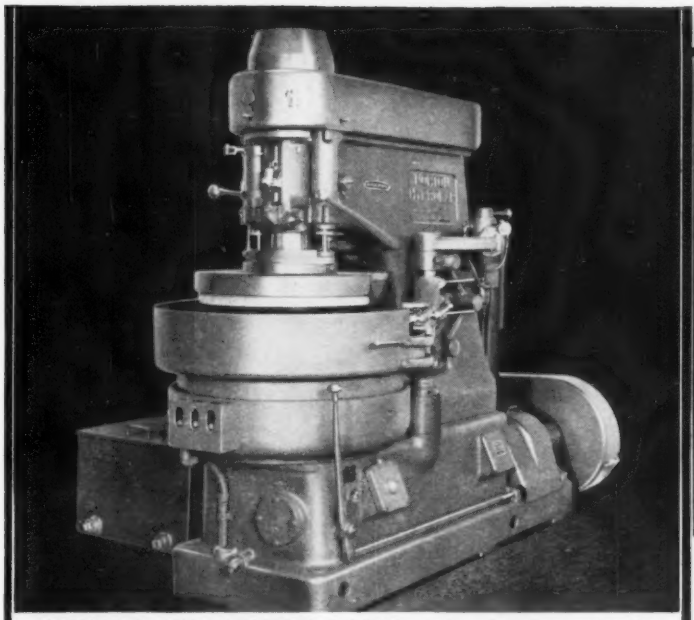
For further facts see your Norton representative or write direct. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

HYPROLAP SINGLE FACE FLAT LAPPING MACHINES #60-F (above) and #36-F (below). Sensational performers using bonded abrasive laps and filtered coolant. Provide clean seal surfaces, wear surfaces or reference surfaces for further machining. Available for small or large production lots: plain timed cycle; automatic continuous feed or semiautomatic continuous feed. Rigid power-operated truing arm insures true flatness of abrasive lap and finished work pieces. Heavy or light parts handled with equal ease.

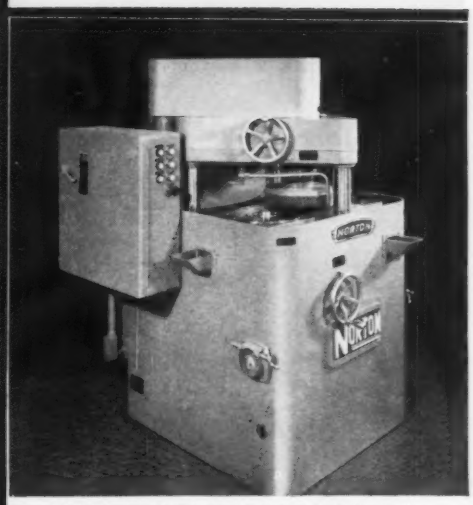




HYPROLAP SINGLE OR PARALLEL FACE FLAT LAPPING MACHINE #48-F. Similar to the #60-F and #36-F Lappers in speed and accuracy, with provision for parallel face flat lapping. For single face flat lapping the machine mounts a single 48" diameter bonded abrasive lap. For lapping opposed parallel flat surfaces an upper lap is added. Arrangements: plain timed cycle; automatic continuous feed or semiautomatic continuous feed.



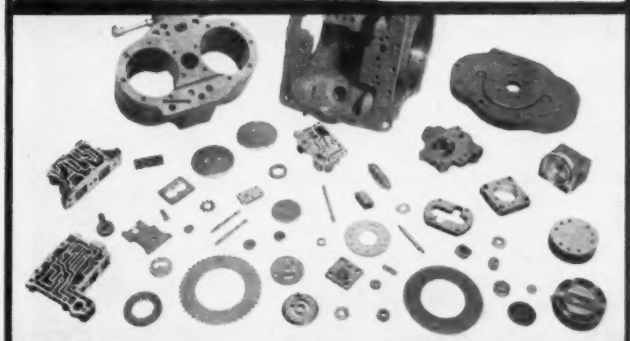
HYPROLAP LAPPING MACHINE #26. A high speed machine for two face flat lapping or cylindrical lapping that finishes up to 100 or more work pieces simultaneously. Lapping pressure is hydraulically powered and controlled — an exclusive Norton development. Arrangements: plain timed cycle; automatic continuous feed or semiautomatic continuous feed. Like other HYPROLAPS, lap truing is hydraulically powered and controlled.



HYPROLAP LAPPING MACHINE #12-F. For small, parallel face flat lapping. Ideal for small ball bearings. Arrangements: plain timed cycle; automatic continuous feed or semiautomatic continuous feed. All three provide fast efficient lapping with selective speeds for laps and work-holders, permitting positive selection of ideal speeds for each job. Cleanliness of finished work surfaces eliminates the need for cleaning operations.

PLAIN TIMED CYCLE LAPPING MACHINE #28. Produces flat or cylindrical surfaces to extremely close tolerances and high degree of finish. Uses cast iron laps with loose abrasive. An attachment for cylindrical lapping is furnished with the regular flat lapping arrangement. For plug gage or gage block tolerances the machine is unsurpassed. An arrangement for hand lapping with 30", 36" or 40" cast iron laps is also available.

PLAIN TIMED CYCLE LAPPING MACHINE #16-FC. An outstanding performer for flat or cylindrical work, such as Diesel injector parts, plug gages, size blocks, sides of rings and short cylindrical parts. Using cast iron laps with loose abrasive it produces optically flat surfaces to extremely close thickness tolerances. Its fine repetitive accuracy helps reduce inspections and eliminates the need for selective assembly.



NORTON JOB LAPPING SERVICE. Improve your product quality by precision lapping. The Norton Job Lapping Department, complete and modern in every detail, is ready to finish jobs to your exact specifications. Flat or cylindrical lapping operations handled quickly to your tolerance specifications. Parallel face flat lapping is our specialty. See your Norton representative or write direct.

To Economize, Modernize with **NEW**

NORTON

GRINDERS and LAPPERS

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
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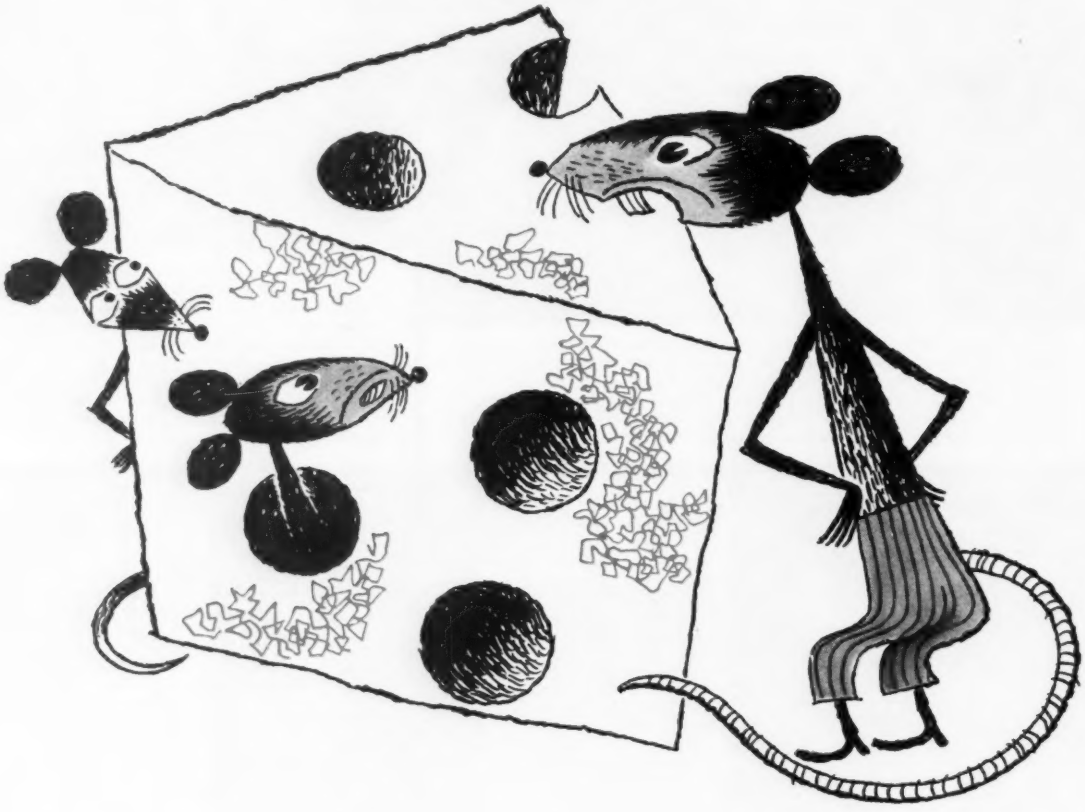
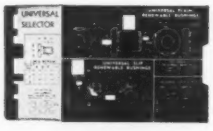
District Offices: Worcester • Hartford • Cleveland • Chicago • Detroit — *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

WHAT...

NO UNIVERSAL DRILL BUSHINGS?



Wherever there are holes to drill using jigs or fixtures, it pays to specify Universal drill bushings. Machined from finest quality steel, Universal bushings have super-finished bores which lengthen tool life and reduce bushing wear over long production runs. Knurled heads provide quick, sure grip. Blended radii on top-inside diameters help prevent tool hang-up and breakage. Standard sizes and lengths in stock for immediate delivery.



FREE UNIVERSAL SELECTOR. Gives all engineering data for selection of all types and sizes of drill bushings up to 1¾" drill size. Send request on your company letterhead.

196

UNIVERSAL ENGINEERING CO. FRANKENMUTH 2, MICHIGAN

For more information fill in page number on Inquiry Card, on page 241

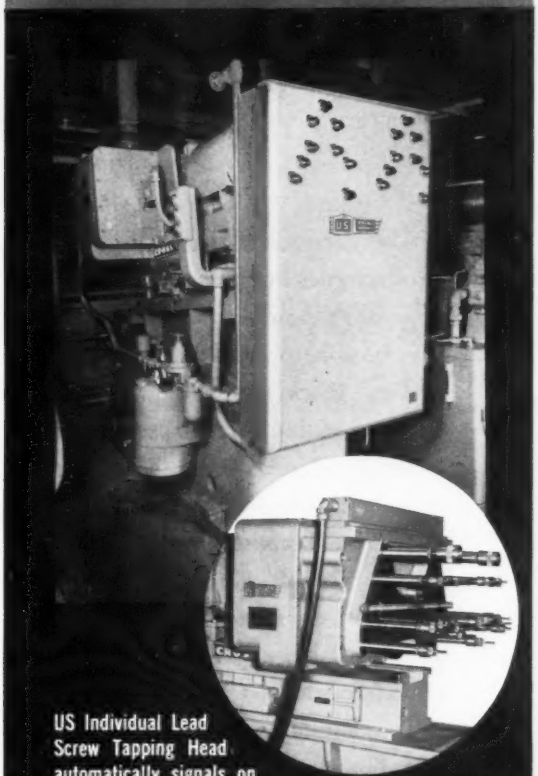
U. S. NAVY PHOTO

Trouble Spotter...

This majestic cruiser is a U. S. Navy airship. Its mission is locating trouble—*ahead of time*. How effective its deadly purpose in convoy is attested by the fact that "no vessel escorted by a blimp in World War II was sunk by an enemy submarine." Its invaluable contribution to our Aircraft Early Warning system is also firmly established. It is a Navy "tool" that virtually eliminates surprise.

The U. S. Drill Head Co.'s new electronic device seeks trouble too—in automated production lines. It locates faulty machining during a "transfer setup" and stops the machine *before* succeeding operations are begun. It minimizes the chance of costly smash-ups and resulting expensive down-time . . . reduces re-operating and scrap-loss costs.

This development is another precision cost-reducing "tool" from the largest exclusive drill head builder in the world.



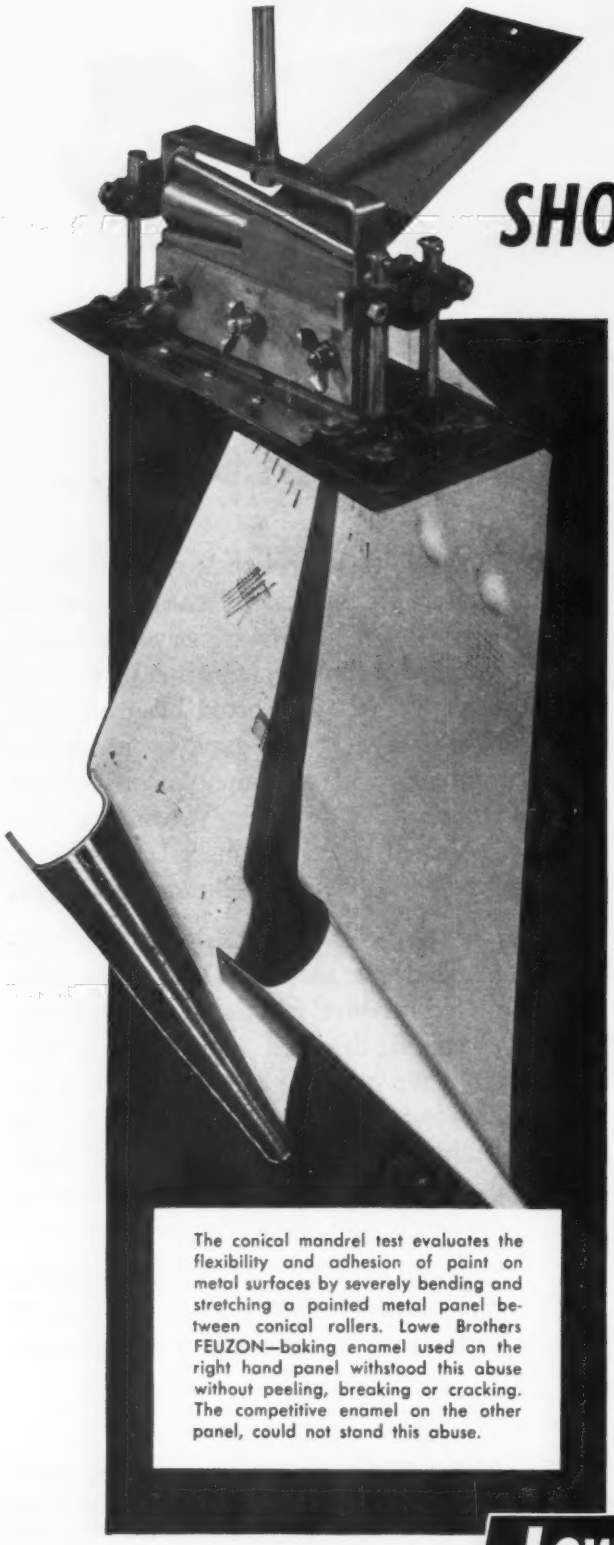
US Individual Lead Screw Tapping Head automatically signals on a light panel exact location of any spindle not tapping to full depth, and stops the entire line. In addition, patented US Safety Tap Spindles prevent all tap breakage due to dull taps or improperly drilled holes. Installed on transfer machines, this exclusive US development provides dual automatic protection during tapping without need for an extra probing station.

We manufacture all types of adjustable, fixed center and individual lead screw tapping heads. Ask us to help solve your multiple drilling and tapping problems.

US DRILL HEAD

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO



The conical mandrel test evaluates the flexibility and adhesion of paint on metal surfaces by severely bending and stretching a painted metal panel between conical rollers. Lowe Brothers FEUZON—baking enamel used on the right hand panel withstood this abuse without peeling, breaking or cracking. The competitive enamel on the other panel, could not stand this abuse.

SHOCK TREATMENT

..bad medicine for the wrong finish

You can't afford to use anything but the right finish. The second best might be cheaper and look just as good, but it will be more costly in the long run.

The "shock" will come after your product goes into home, office or plant. The finish must not only look good but also be able to take wear and abuse.

The "shock treatment," more severe than any encountered in actual service, is simulated in Lowe Brothers Technical Service Laboratory to determine in advance the reliability of each finish. The two test panels at the left which have been bent and stretched, graphically emphasize that the best paint is the most economical finish in the long run.

To make sure you get the right finish everytime, call or write Lowe Brothers Company, 424 East Third Street, Dayton 2, Ohio.

LOWE BROTHERS

INDUSTRIAL FINISHES

also Style-Tested paints for the home

For more information fill in page number on Inquiry Card, on page 241

HOW TO LAND A PRIZE CATCH

If you're casting about for ways to save money and increase your production, then you'll land a prize catch when you hook-on to CIMCOOL°—the radically new and different cutting fluid. Here are just three reasons why you'll want to net CIMCOOL Concentrate:

- **CIMCOOL LOWERS COSTS** because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.
- **CIMCOOL DOES A BETTER JOB** because of its chemical lubricity. It permits faster speeds and feeds, for it combines friction reduction and cooling capacity in a degree never before attained by old-fashioned coolants.
- **CIMCOOL IS CLEAN,** doesn't soil clothing or hands. It contains no skin irritants. It leaves no slippery film on shoes, floors, machine or work. It can't smoke, can't burn, and virtually eliminates rancidity and foul odors.

So, cast a line in the direction of your CIMCOOL Distributor. He'll give you complete information on CIMCOOL Concentrate— and the entire family of CIMCOOL Cutting Fluids. Or contact us direct. We'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

CIMCOOL CUTTING FLUIDS

CIMCOOL **Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL **Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT **Concentrates** — For jobs requiring oil-base cutting fluids. Added to mineral oils, they give economical mixes for higher speeds and feeds.

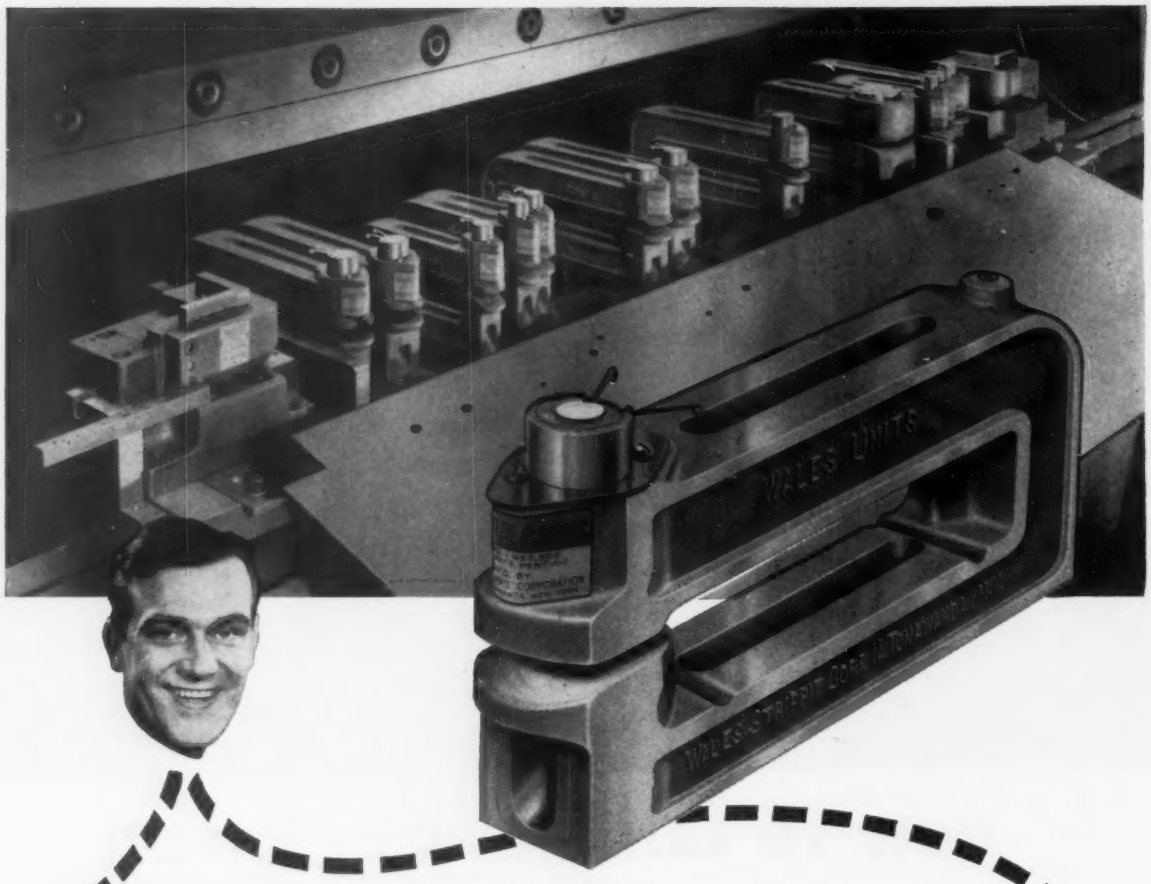
CIMCOOL **Bactericide** — The most effective agent yet developed to overcome rancidity and foul odors.

CIMCOOL **Machine Cleaner** — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

°Trade Mark Reg. U.S. Pat. Off.

CIMCOOL Cutting Fluids *for 100% of all metal cutting jobs*

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.



"WALES BL TOOLING SAVES US ABOUT HALF THE COST OF HOLE PUNCHING"

"WALES BL tooling is fast and accurate in our shop. Punches, dies and stripping mechanism are all contained right in the tooling, so our presses have a minimum of down time for change-overs. BL's are just about perfect for punching stock up to ⅛" thick and we get any type of pattern needed with the same units."

Nothing is attached to the press ram. Alignment of punch and die is permanent.
Notching equipment may be used in the same set-up.
Inventory is kept down and PRODUCTION UP!
A good buy for any shop.

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"...the Wales-Way is the PLUS-PROFIT way"

SEND FOR BULLETIN No. 16D
The complete story of BL tooling is here for the asking. Send for your copy today.

WALES MOBILE FIELD UNITS
Let us arrange for a Field Unit to visit you. Send for details.

For more information fill in page number on Inquiry Card, on page 241

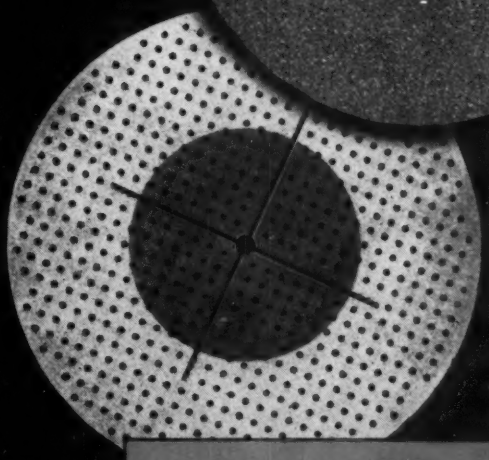
The right disc *surface* can *lower* your abrasive costs!

Deep corrugated for fast, cool cutting: small, medium and large corrugations

Smooth face for general purpose grinding: small areas, fine finishes

Two grades to maintain disc flatness on heavy shear cuts

Radial lines for better coolant distribution



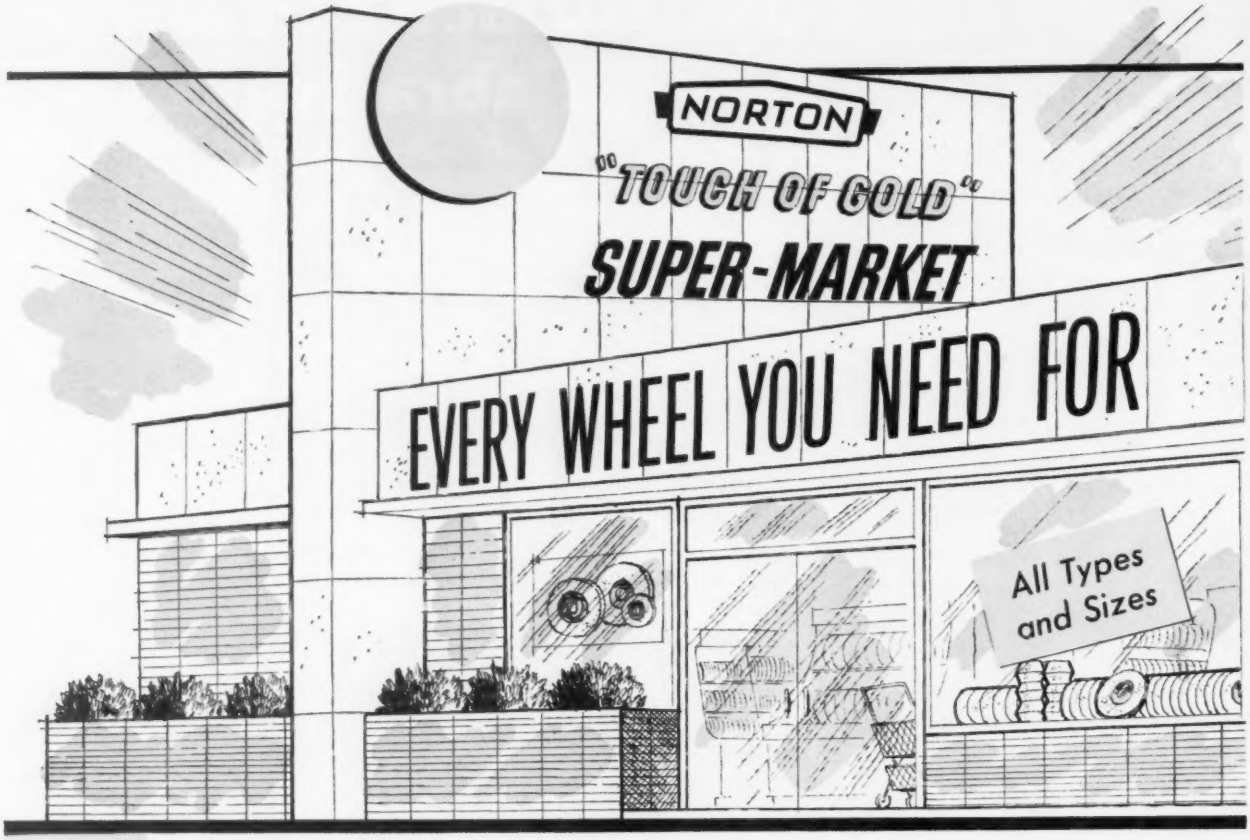
Combination for special applications

there's a Gardner Disc Surface to fit every job . . .

GARDNER

abrasive discs

BELOIT, WISCONSIN



Let's toss a bouquet to the modern super-market — one of the greatest time and trouble savers in present-day living.

But, have you ever stopped to think that, in the abrasives field, Norton brings you real super-market convenience? Here, in the world's largest line of abrasive products, is everything you need for every grinding job.

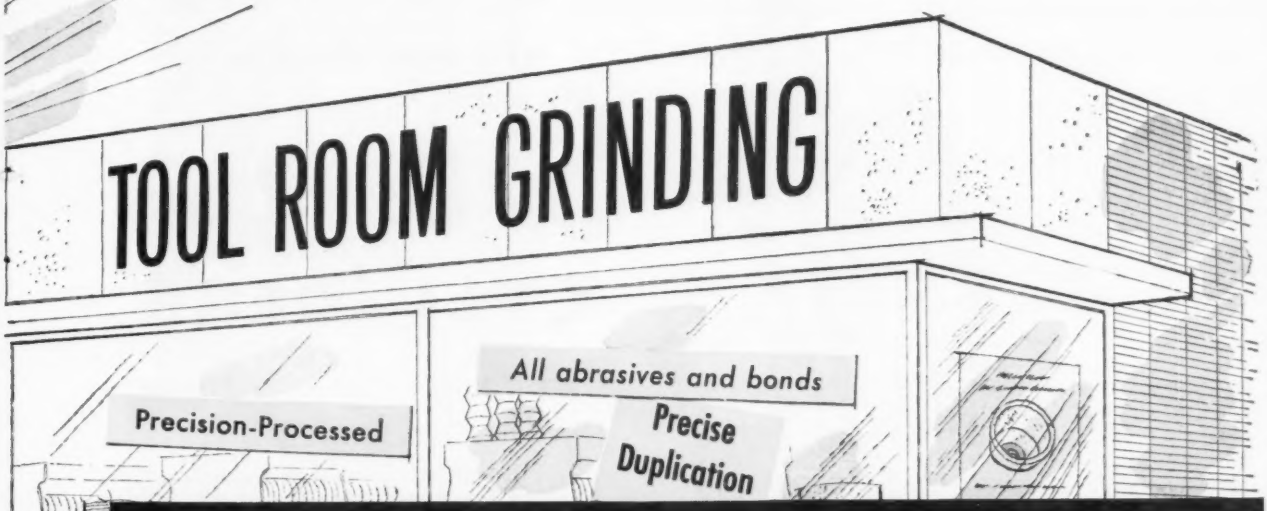
Take tool room grinding wheels. In these, as in all other categories, the Norton line is 100% complete. You don't have to shop around — going to one source for wheels that will sharpen steel tools, to another for diamond wheels, to another for mounted wheels.

You can get them all at Norton. And they're all the best wheels that can possibly be made. The advanced equipment and broad experience you find at Norton you'll find nowhere else in abrasives manufacture.

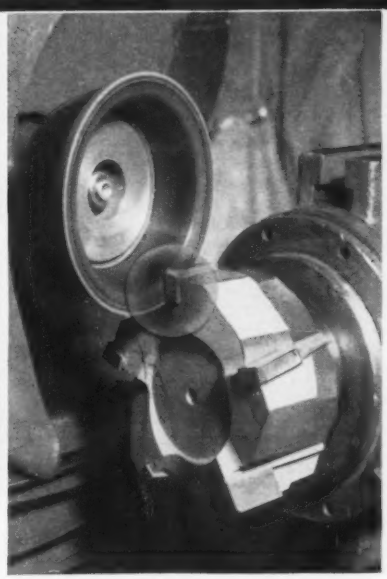
Advantages like these mean leadership. And they result in precision-processed, precision-performing wheels that grind exactly alike — from wheel to wheel and lot to lot.

See Your Norton Distributor for wheels that will bring the value-adding, profit-boosting "Touch of Gold" to all your tool room grinding operations. Ask him for the two helpful booklets — *A Handbook on Tool Room Grinding* and a booklet on *How To Select Wheels For Precision Grinding Tool And Constructional Steels.* Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. Behr-Manning Company, Troy, N. Y., a division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated. **For the booklets or other information write to Norton Company, Worcester 6, Mass.**

TOOL ROOM GRINDING



FOR SHARPENING STEEL TOOLS, as well as for surface, cylindrical and internal grinding on all steels, Norton G Bond and BE Bond Wheels — in 32 ALUNDUM*, 38 ALUNDUM, 19 ALUNDUM or the new non-premium priced 44 ALUNDUM abrasive — add the money-saving, cost-cutting "Touch of Gold." These vitrified bonds are the most efficient ever developed for precision and semi-precision grinding.



FOR CARBIDE GRINDING, Norton diamond wheels are the recognized "Crown Jewels." Made in the regular B resinoid bond for wet grinding and the B6 resinoid bond for dry grinding. For many carbide grinding jobs Norton K Bond CRYSTOLON* wheels are often the best investment.

FOR DIE AND MOLD FINISHING Norton mounted wheels bring you big savings on the widest range of tool room jobs. They're a 100% complete line, for all requirements.

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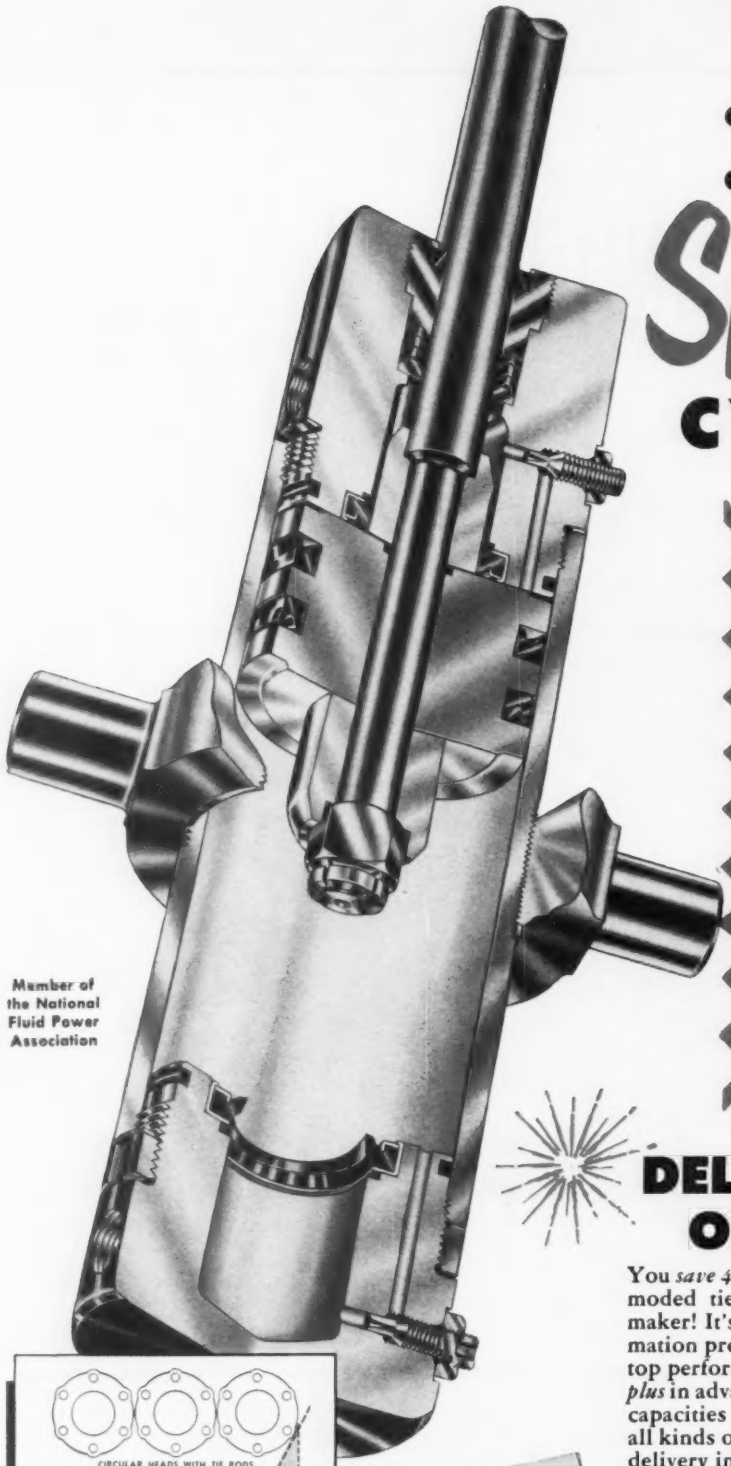
NORTON
ABRASIVES

Making better products...
to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening
Stones • Behr-cat Tapes

W-1763

all the EXTRAS are standard with T-J Spacemaker CYLINDERS



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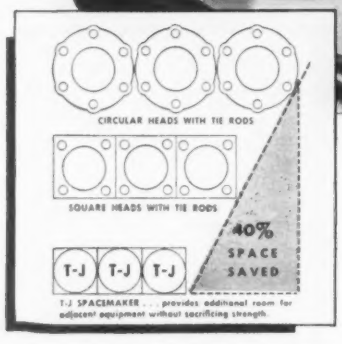
- **NEW** *exclusive* ingenious cushion designs . . . Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Cushion for Oil.
- **STRONGER** than outmoded tie rod design, proven through actual tests. No tie rods to stretch.
- **SOLID STEEL HEADS** throughout the full line.
- **COMPACT DESIGN** eliminates tie rods, increasing the strength and reducing mounting space required, providing extra room for adjacent equipment.
- **HARD CHROME PLATED** body bores and piston rods . . . assure you of long trouble-free service. (Standard at no extra cost.)
- **METALLIC ROD SCRAPER,** not just a wiper, actually removes foreign matter from the rod.
- **PILOTED PACKING GLAND** with extra long bearing. Additional strength and support to the piston rod.
- **OIL** pressure to 750 p.s.i. AIR to 200 p.s.i.


CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
40% SPACE SAVED
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T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

DELIVERY OFF THE SHELF!

You *save 40% space* when you switch from outmoded tie rod cylinders to the T-J Spacemaker! It's stronger, too! Fits right into automation programs in countless plants. Delivers top performance and dependability with a big *plus* in advanced features. Wide range of styles, capacities . . . reduces man-hours and costs in all kinds of push-pull-lift operations. Off-shelf delivery in 64,000 combinations!

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T-J TOMKINS-JOHNSON
RIVETORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

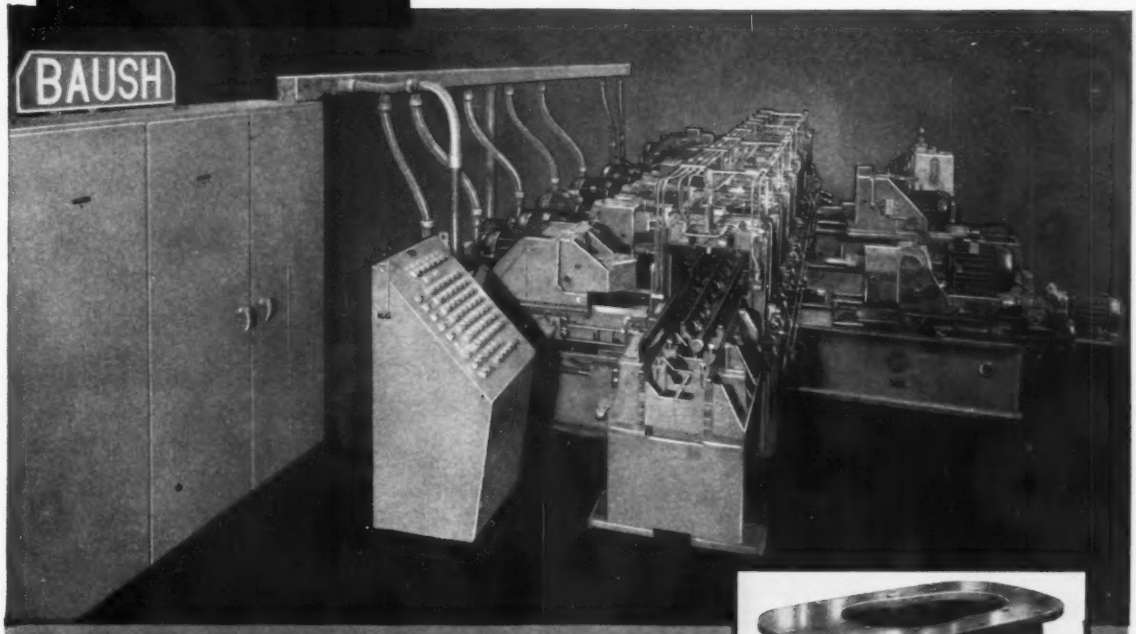
FOR USE IN GREAT BRITAIN

A 10 Station Baush Horizontal Automatic Transfer Line built for a leading British automobile manufacturer to perform operations on top and bottom of transmission case.

This 10-station horizontal transfer consists of —

- 1 Loading Station
- 7 Working Stations
- 1 Blow-off Station
- 1 Unloading Station

The transfer line is made up of 4 Horizontal Hydraulic Slide Units and 5 Horizontal Mechanical Leadscrew Units having 9 Fixed Center Heads equipped with a total of 32 spindles.



Operations performed are: Mill, Drill, Ream, Countersink, Chamfer and Tap. Individual leadscrew spindles are used for tapping and lubrication is by air-oil mist.

Production is 62 Transmission Cases per hour, or 1984 operations, working at 100% efficiency.

If it is rugged reliability, accuracy and economy of operation you are looking for in single purpose multi-spindle machine tools, then you want BAUSH MACHINE TOOLS.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

We know Baush can help — why not call us!

For more information fill in page number on Inquiry Card, on page 241

how's this for performance?

15 lbs. of scrap after cutting 156 parts from a 6′ x 10′ plate of ⅜″ steel

Using four torches guided by an electronic tracer, an Airco #48 Duograph automatically flame cut 156 parts from a ⅜″ x 72″ x 120″ steel plate. Of the original 918 pounds of sheet steel, only 15 pounds of scrap remained. Discover the advantages to be gained by using Airco flame-cutting machines for fast, economical production. In addition to the #48 Duograph, Airco flame-cutting machines include the Airco Travograph, Oxygraph, Duograph, Monograph, Camograph, and Radiagraph. Write Airco for complete information and literature.

AT THE FRONTIERS OF welding PROGRESS YOU'LL FIND . . .

AIRCO®

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Products of the divisions of Air Reduction Company, Incorporated, include: **AIRCO** — industrial gases, welding and cutting equipment, and acetylenic chemicals • **PURECO** — carbon dioxide — gaseous, liquid, solid ("DRY-ICE") • **OHIO** — medical gases and hospital equipment • **NATIONAL CARBIDE** — pipeline acetylene and calcium carbide • **COLTON** — polyvinyl acetate, alcohols, and other synthetic resins.

Assemble "A" GRADE WORKING GAGES with DoALL Shop Blocks and MICRO-STEP

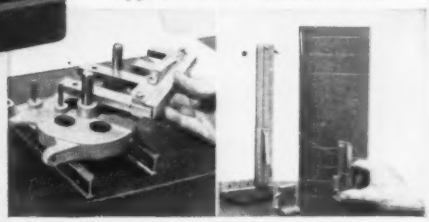
only $265.00 for 84 piece set
only $130.00 for 36 piece set

NEW SHOP-BLOCKS

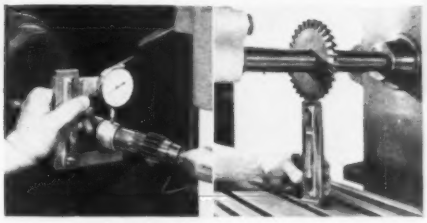
GUARANTEED
"A" grade accuracy at less than "B" grade prices!

ACCURACY: + .000006" — .000002"
FINISH: 0.8 AA or better
FLATNESS: .000004"
PARALLELISM: .000004"
HARDNESS: 65 Rockwell C

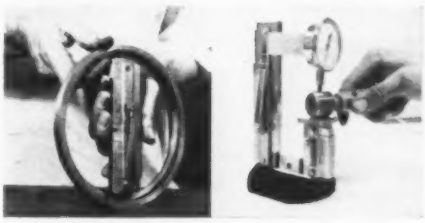
Typical GAGE ASSEMBLIES



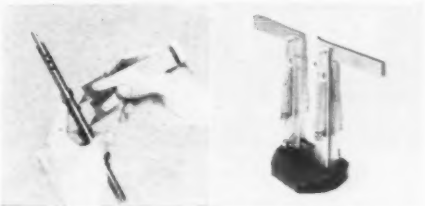
Go—no go gage | Scribers



Indicating Snap Gage | Height Gage



Ball End Pin Gage | Indicating Comparators



Special Caliper Gage | Go—No go Height Gage

MAKE 1000's of SHOP GAGES with Micro-Step Gaging System

Here is an unbeatable combination for improving dimensional control in your shop...reducing rejects...eliminating waste...and, you reduce your gage costs:

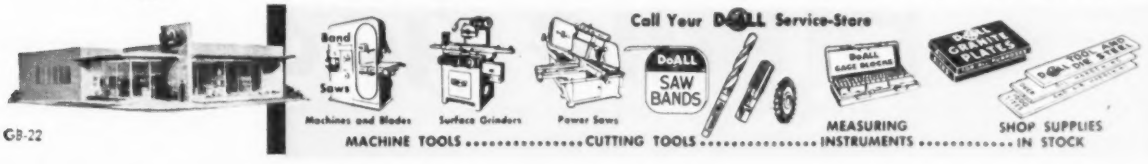
1. New Low-Priced DoALL Shop Blocks — the only A Grade "working" gage blocks available today. Here is the accuracy you need to control modern tolerances of .001" and finer. DoALL has completely discontinued manufacture of B Grade gage blocks, as totally inadequate for today's needs. Now you get A Grade blocks at less than B Grade prices. Compare them and see.

2. DoALL Micro-Step Gaging System — unique and versatile accessories enable you to quickly assemble thousands of different gage block gages for shop use. The Micro-Step System eliminates the need for many special gages, gives you superior accuracy and enables you to use your gage blocks constantly with practically no wear.

Your local DoALL Store can tell you more about how you can cut costs and improve production with new DoALL Grade A SHOP BLOCKS ... and the Micro-Step System. Call DoALL today or write.

ASK FOR LITERATURE

The DoALL Company
Des Plaines, Illinois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GB-22

We've come a long way in...

Grant's "Gear Book for 1893".

YESTERDAY —

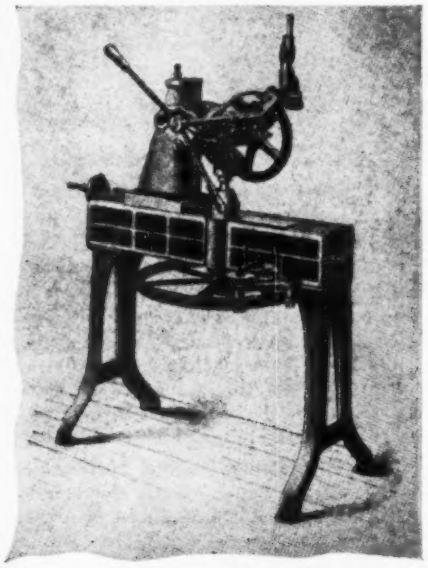
Philadelphia Gear Works was established by George B. Grant in 1892 for furnishing cut tooth gears at a time that cast tooth, or mortise gears with inserted wooden teeth, were used for transmitting power.

The contribution made by George B. Grant to the American gear cutting industry was considerable. He pioneered many gear firms in this country, some still in existence.

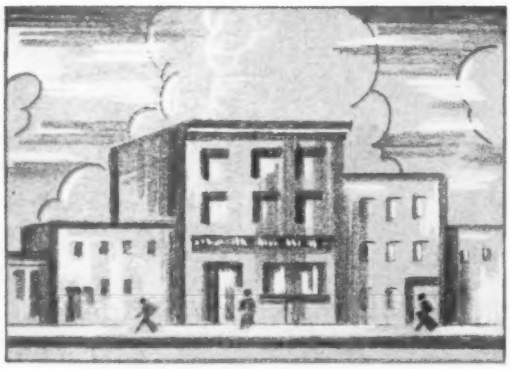
The first hobbing machine for cutting spur gears was built by Grant in 1887 (U. S. A. Patent No. 405,030). In 1899, he gave the hypoid its name though it was not until 1925 that a practical method was developed for producing these gears.

Grant contributed greatly to the development of the involute tooth by championing as early as 1885 the use of the involute form, at a time when there was much controversy over the involute versus epicycloidal tooth.

Grant invented an Odontograph and published Grant's Treatise on Gears which for many years has been the gearing text in use by colleges and engineers.



Machine built by Grant for cutting bevel gears in 1893.



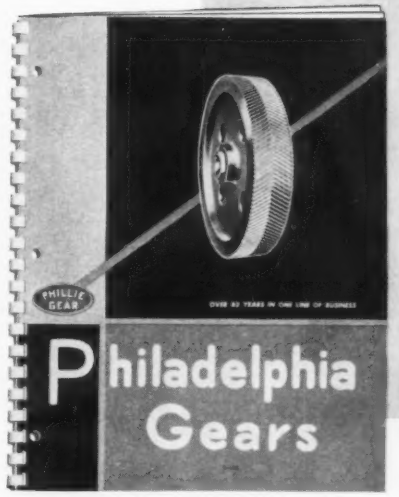
The original plant occupied by Philadelphia Gear Works at 125 S. 11th St., Philadelphia.

phillie gear®

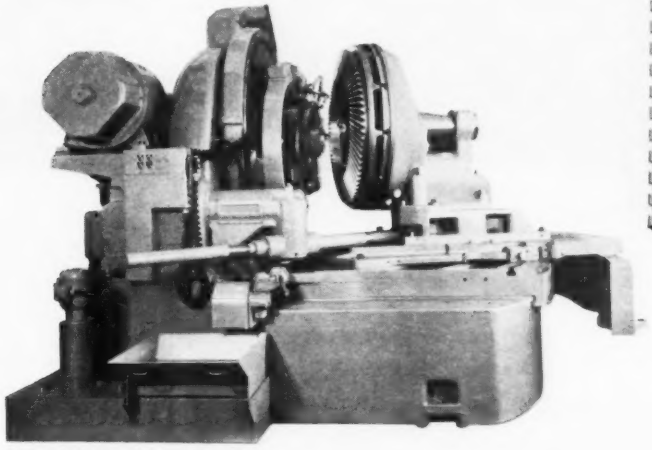
....65 YEARS
OF GEAR MAKING

TODAY—

Philadelphia Gears are made to the highest standards of engineering skill and exactitude. They are the culmination of over 65 years' specialized experience in the manufacture of gears. Our shops are equipped with the latest gear making machines, many of which incorporate exclusive design features. Today our gear manufacturing facilities are among the largest and best equipped in the country. Our competent engineering staff, expert craftsmen and modern quality control facilities assure you of advanced gear design service and consistently better gears with longer life.



—it's practically a "treatise" on gears— Never before has so much helpful information been assembled between the covers of a gear catalog . . . 72 pages of illustrations, diagrams, definitions, tables, charts, and explanations regarding all types of gears. Write on your business letterhead for your copy.



New No. 70 Spiral Bevel Generator designed to cut large spiral bevel gears up to 72" diameter, 10" face widths.

PHILADELPHIA PLANT No. 1

PHILADELPHIA PLANT No. 2

VIRGINIA PLANT

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G STREET. PHILADELPHIA 34, PENNA.
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

Virginia Gear & Machine Corp. • Lynchburg, Va.

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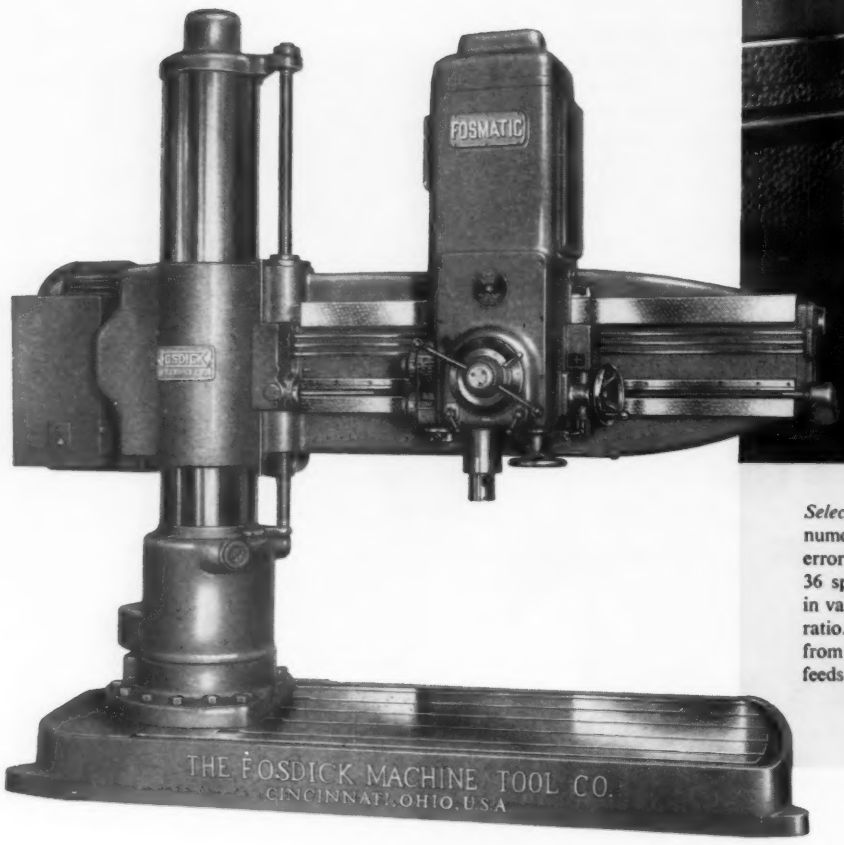
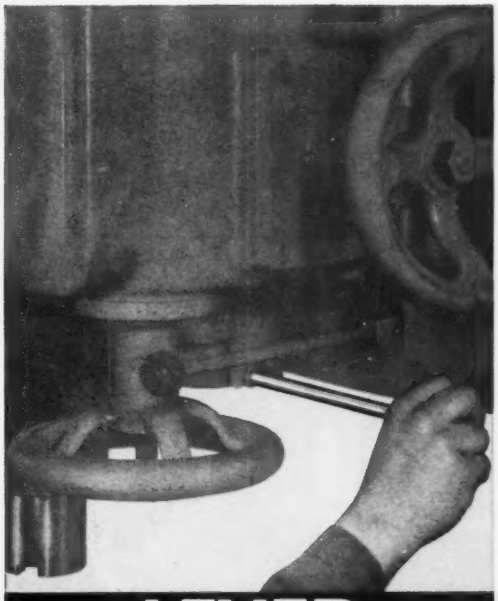


Select feeds and speeds with easy-to-read numerical dials. Minimum possibility of error. To save time, select while drilling. 36 spindle speeds, maximum 3000 rpm, in variety of ranges, each with 127.5 to 1 ratio. 18 feeds, including 6 tap leads, from .003″ to .125″. Electronic milling feeds are also offered—from ¾ to 15 ipm.

FOSMATIC RADIAL

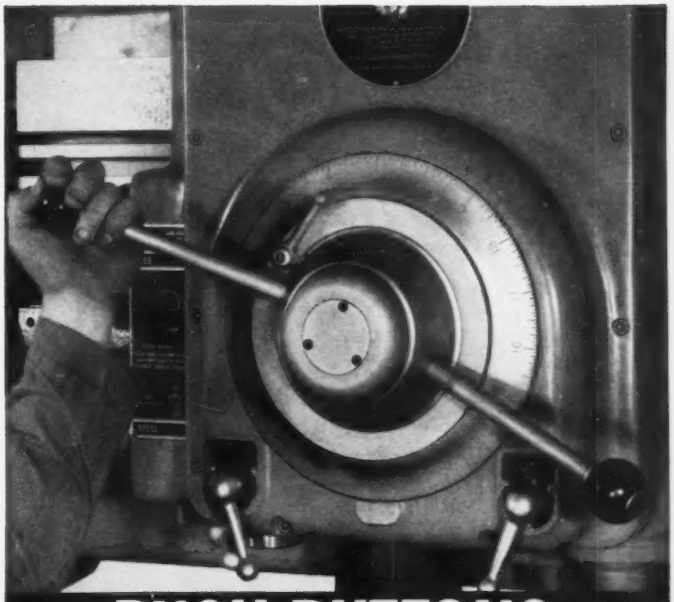
SIMPLE CONTROLS

FAST, EASY PRECISION DRILLING



LEVER

Shift, start, stop and reverse with single lever. Shifting to new feeds and speeds is accomplished by raising lever slightly in its neutral position. For faster tapping, reverse spindle speed is up to 40% faster than forward speed.



PUSH BUTTONS

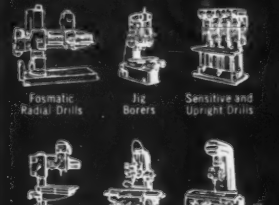
Engage feed by pressing button on either quick-return handle. Feed is disengaged by depth control or by pressing either button again. Feed dial is graduated to full spindle travel, to eliminate resetting for deep holes. Powerful magnetic clutch which engages feed will never need adjusting. Head and column can be clamped automatically when feed is engaged, if desired. They are unclamped by independent levers.

Fast, rigid, precise, easy to run—that's what today's machine shop demands in a radial. And that's what makes the Fosmatic outstanding among radial drills. The simple controls shown here save valuable seconds of operator's time, with each hole drilled. Other convenient controls at the head—single lever to raise and lower arm (hydraulic clamp interlocked) and traverse head; hydraulic column clamp; hand feed and traverse to head; tool ejector eliminates need for tang driver.

The new boring-type spindle is of heavy section with bearings placed far apart for extreme rigidity; it can be used for boring, milling and the heaviest drilling. A new and unique counterbalance produces equal tension on the spindle whether it is extended or close to the head. Case-hardened gears are ground on the finest equipment available. They run on ground splined shafts which are mounted in ball bearings. Lubrication is automatic.

Our new arm is the strongest in the business. It has a double box section with very heavy walls; ways have been widened considerably. The head is mounted on roller bearings on hardened and ground ways with an additional roller support in back of the arm. Safety nut is hydraulic. Column is superfinished.

Standard sizes available with 4' to 8' arms, 13" to 19" columns. Write for Catalog RD-A.



NEED DRILLING EQUIPMENT?
GET A PROPOSAL FROM FOSDICK!

FOSDICK

THE FOSDICK MACHINE TOOL CO.
CINCINNATI 23, OHIO

BALANCED ACTION TOOLS BY WINTER

Winter tools are available from your distributor and from complete stocks at branch warehouses in New York • Chicago • Dallas • San Francisco • Los Angeles and at the Winter factory in Rochester, Michigan.

TAPS

Hand Taps
Machine Screw Taps
Chip Driver Taps
Nut Taps
Pipe Taps
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and various types of Taps for Special Applications

GAGES

A complete line of Plug and Ring Gages, Thread and Plain

DIES

Adjustable Round Split Dies
Hexagon Rethreading Dies
Solid Square Bolt Dies
Solid Square Pipe Thread Dies

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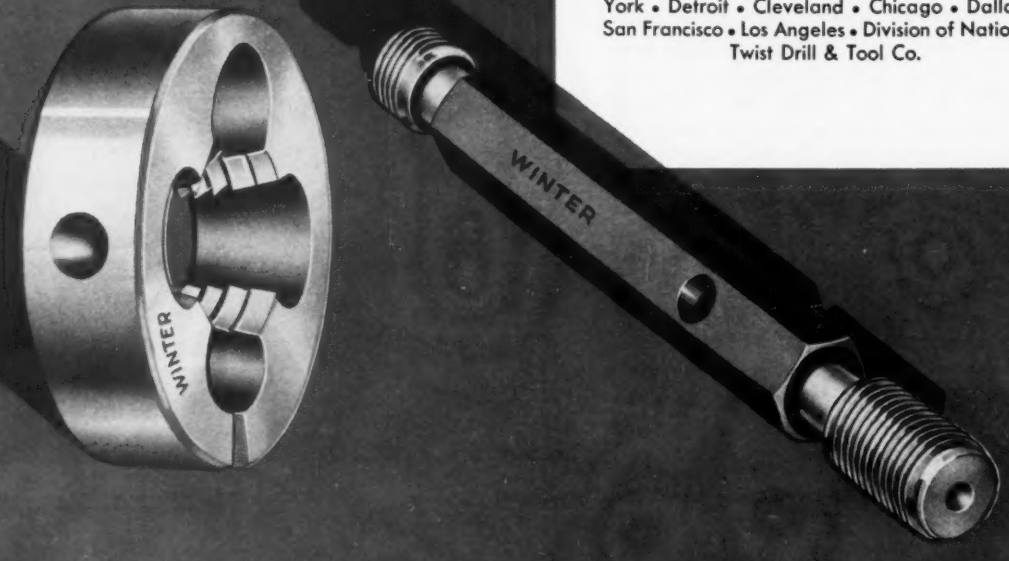
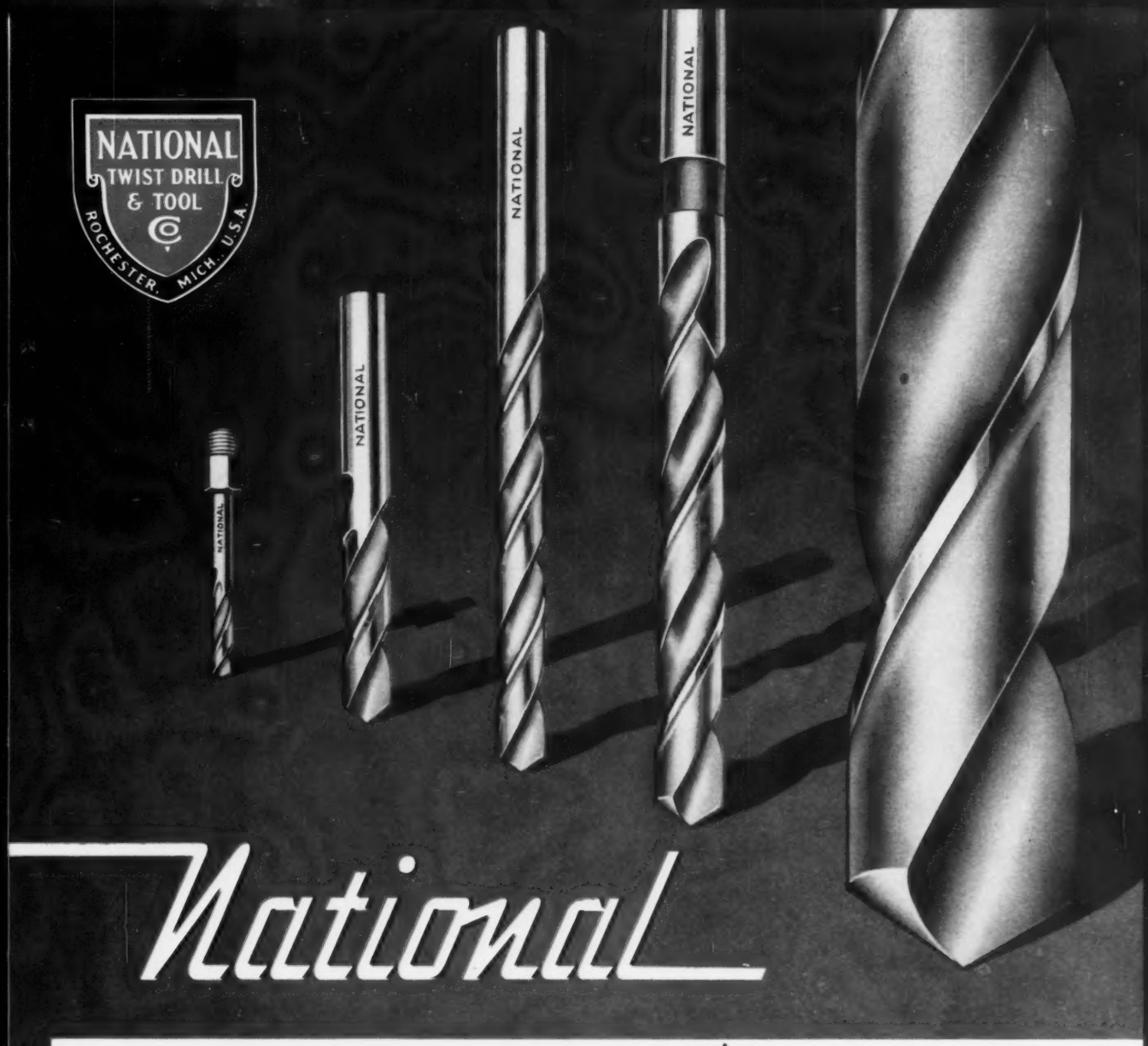


WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles • Division of National Twist Drill & Tool Co.



They Meet the Challenge of Today's Harder-to-Machine Metals

Not long ago it was said of some titanium and stainless steel alloys and of several high-tensile-strength steels: "They must be ground." But after concentrated laboratory research, National has improved its standard tools so that they now cut many of these harder metals.

NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles

CALL YOUR NATIONAL DISTRIBUTOR

TWIST DRILLS • REAMERS • COUNTERBORES • MILLING CUTTERS • END MILLS • HOBS • CARBIDE AND SPECIAL TOOLS

The search that never ends

Experimental drilling of one of the hard-to-cut materials

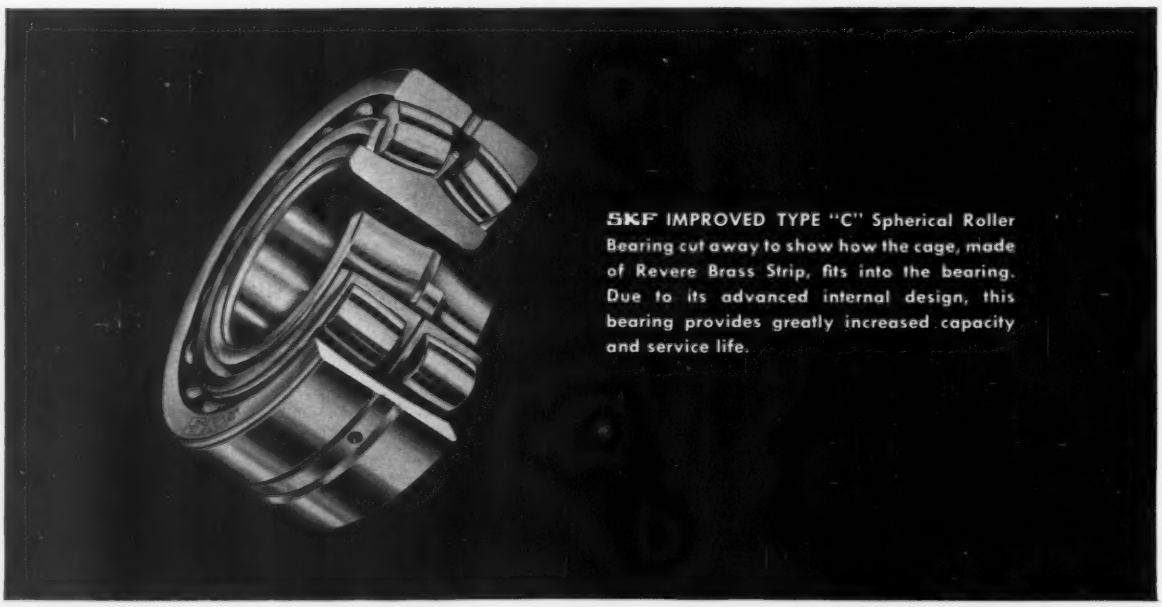
How SKF Saved in 7 Ways

and at the same time improved its roller bearing cages by using the right

Revere Brass Strip

SKF Industries, Inc., Philadelphia, Pa., like other progressive organizations, is constantly seeking new ways to improve its products and at the same time cut production costs.

With this in mind they recently reviewed the kind of brass which was being used in their spherical roller bearing cages from the standpoints of quality and fabrication. It was then that Revere's Technical Advisory Service studied the problem first-hand and made recommendations to the **SKF** production and engineering departments.



SKF IMPROVED TYPE "C" Spherical Roller Bearing cut away to show how the cage, made of Revere Brass Strip, fits into the bearing. Due to its advanced internal design, this bearing provides greatly increased capacity and service life.

HERE IS "window-type" cage of SKF Spherical Roller Bearing, made in two pieces, one for each row of rollers. Cage is made from rugged Revere Brass Strip at the Shippensburg, Pa., plant of SKF Industries, Inc.

The result was the adoption of specification changes in brass strip as recommended by Revere which gave SKF these 7 money, time and tool-saving advantages:

1. One bore pressing operation has been eliminated. Machining is more easily accomplished. Less machining is required.
2. Tool life has been increased with some speeds increased up to 100% and feeds up to 30%.
3. Rework due to burrs has been greatly reduced. One step less is required in the deburring operation while savings through reduced cycle time for remaining deburring operations are up to 40%.
4. Chips are small now . . . there is no "angel hair" to clutter work area.
5. Life of punch used in notching roller bearing cage has been doubled. Now a run may be completed without making tool adjustments due to sharpening tools.
6. Machining speeds and feeds have been substantially increased over those in machining the former alloy.
7. Die setters report that considerable work has been eliminated in setting up the tools used.

And, all of these money-saving things were accomplished without sacrificing quality—in fact the quality of these roller bearing cages was *improved!*

This is still another eye-opening example of Revere supplying the metal that will do the best job and with the greatest economy . . . be it brass, copper or aluminum or any one of their alloys.

Why not call in Revere's Technical Advisory Service to review your operation? It may mean money saved with an improved product to boot.

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N.Y.

Mills: Baltimore, Md.; Brooklyn, N.Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

COPPER • BRASS • REVERE • ALUMINUM 1801

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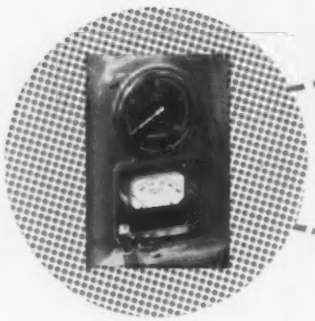
Some day every good lathe will feature



CONSTANT SURFACE CUTTING SPEED

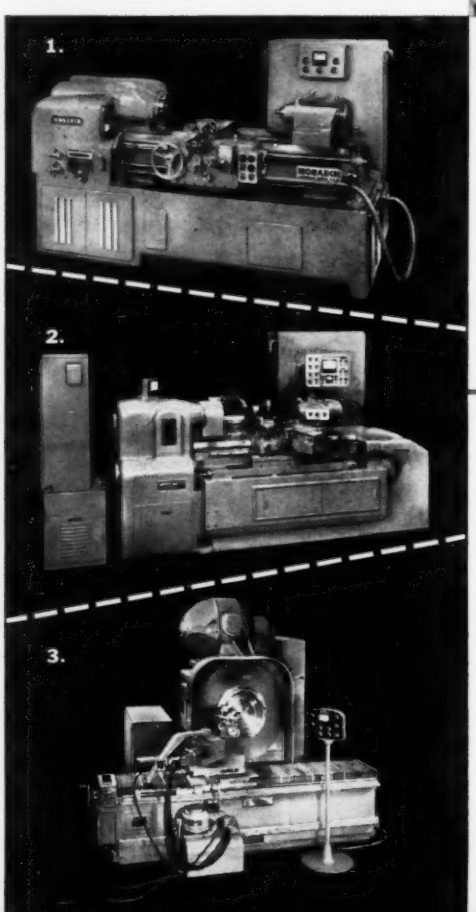
These Monarch Lathes have it now!

Monarch Series EE—Model 1000. **1.**

Monarch Model 21 Monamatic. **2.**

Monarch Right Angle Lathe—Model F. **3.**

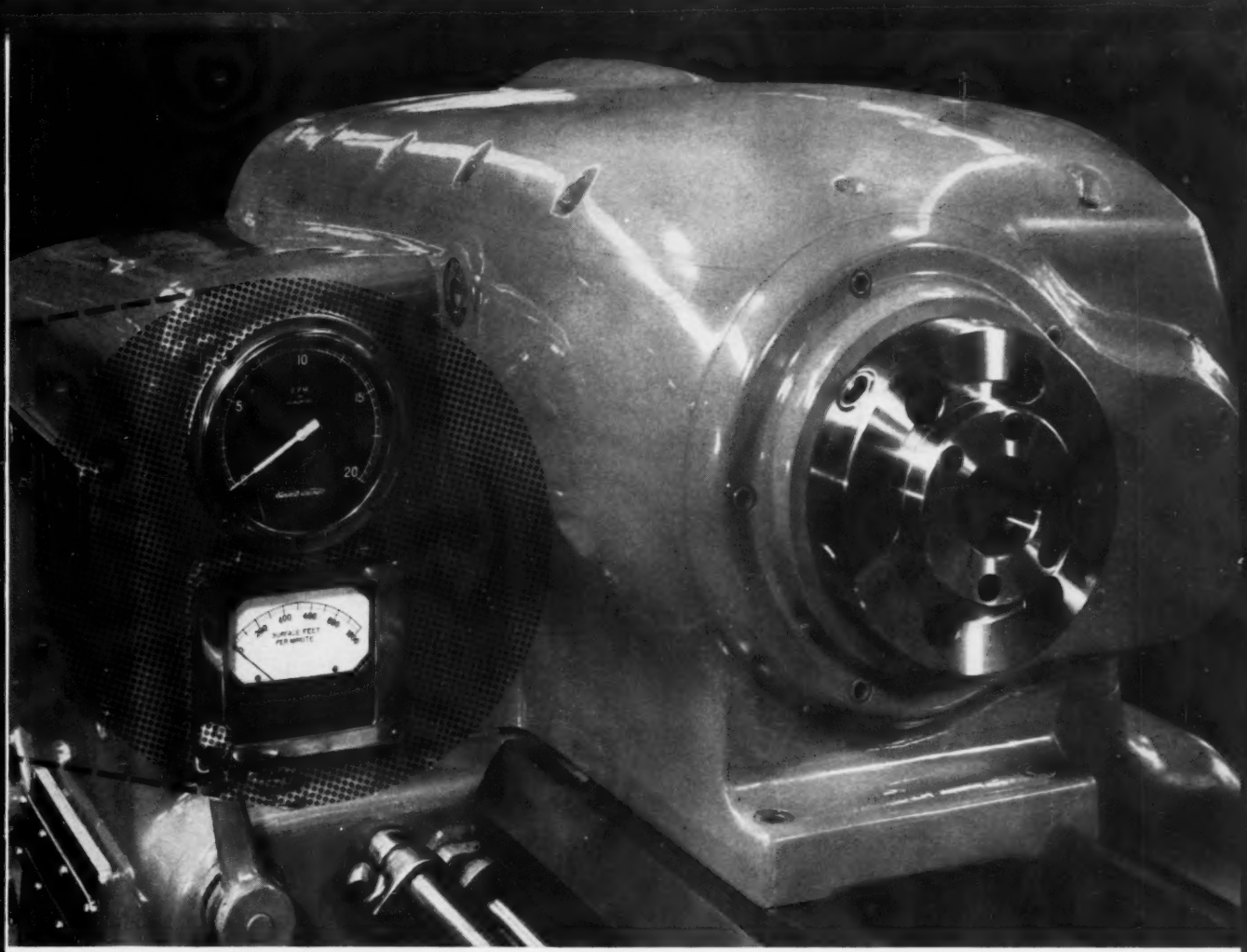
Series 61 Engine and Toolmaker's / Models M, N and NN Heavy Duty — **On special order**



Why buy obsolescence? Why buy a lathe that cut after cut, day after day can't deliver the full metal removing capacity built into it? Why buy anything less than optimum turning for today and tomorrow, both? Why buy less than Monarch?

There are plenty of reasons why you can bet on Constant Surface Cutting Speed. You've got your machine at full load throughout the cycle, increasing output from 30 to 40% on production shaft work—more on facing cuts and forgings. You're getting up to 50% more tool life, avoiding both the tool life loss of excessive speeds and the tool breakage and work distortion resulting from the increased tool forces caused by low speeds. And naturally, you get better finish and reduced power requirements.

Constant Surface Cutting Speed is the coming thing by all the laws of common sense and economics! Buy it now—buy it ahead—with Monarch . . . *The Monarch Machine Tool Company, Sidney, Ohio.*



Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

MONARCH DYNA-SHIFT LATHES

While Dyna-Shift construction does not provide Constant Surface Cutting Speed as such, it's a close approach to such an ideal—with less initial investment. Surface speeds are selected—or preselected—by dial. There is a much greater range and number of speeds. Speed shift is a matter of seconds and it's both automatic and foolproof. Look into the Dyna-Shift—with the headstock that thinks!

Monarch Series 62 Preselector Dyna-Shift

Monarch Series 80 Heavy Duty Dyna-Shift

Monarch Series 90 Heavy Duty Dyna-Shift

New Snyder Special Transfer Replaces Automation in Processing Forged Steel

Special Features of Snyder Machine No. 55-44

1. Production: 146 pieces per hour.
2. 26 Stations: 28 Operations per piece: 2 milling, 1 sawing, 4 hollow milling, 3 reaming, 1 countersinking, 10 drilling, 5 spotfacing, 1 threading and 1 tapping.
3. Palletized fixtures each carrying two parts.
4. Parts quickly and accurately clamped and located and unclamped by combination torque wrenches and hydraulically operated mechanisms at Stations 1 and 26.
5. Ten individual base segments provide maximum flexibility for future part design changes.
6. Ample room between segments for tool changes and maintenance.
7. Motorized fixture return conveyor with fixture washing unit.
8. Ample chip and coolant facilities.

Standard Features of Snyder Machines

1. SNYDER SELF-CONTAINED UNITS and other units equipped with hardened and ground ways.
2. Threading and tap heads equipped with individual leadscrew spindles.
3. Minimum downtime for tool changes because spindles are arranged for pre-set cutting tools.
4. Standard and special parts interchangeable for speed and economy in maintenance.
5. Motorized automatic lubrication system for all moving parts.
6. Construction to J.I.C. Standards throughout.
7. Master Push Button Panel and Light Console at Station 1.
8. Each unit equipped with its own push button control station for ease of tool setup and manual operation of unit.
9. Electrical interlocks and full depth circuit throughout.
10. Panels equipped with SNYDER CIRCUIT SLEUTH.

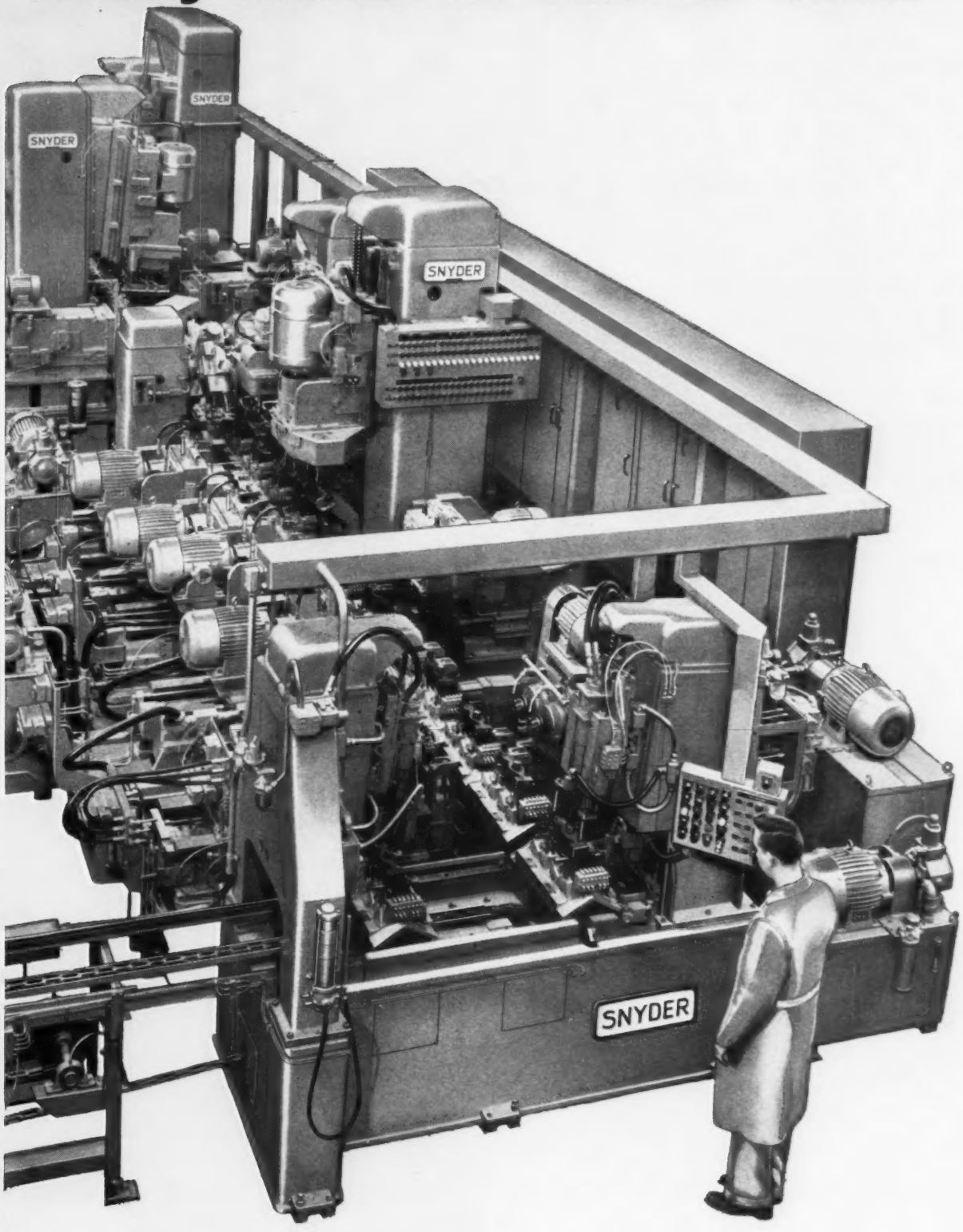
SNYDER

TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

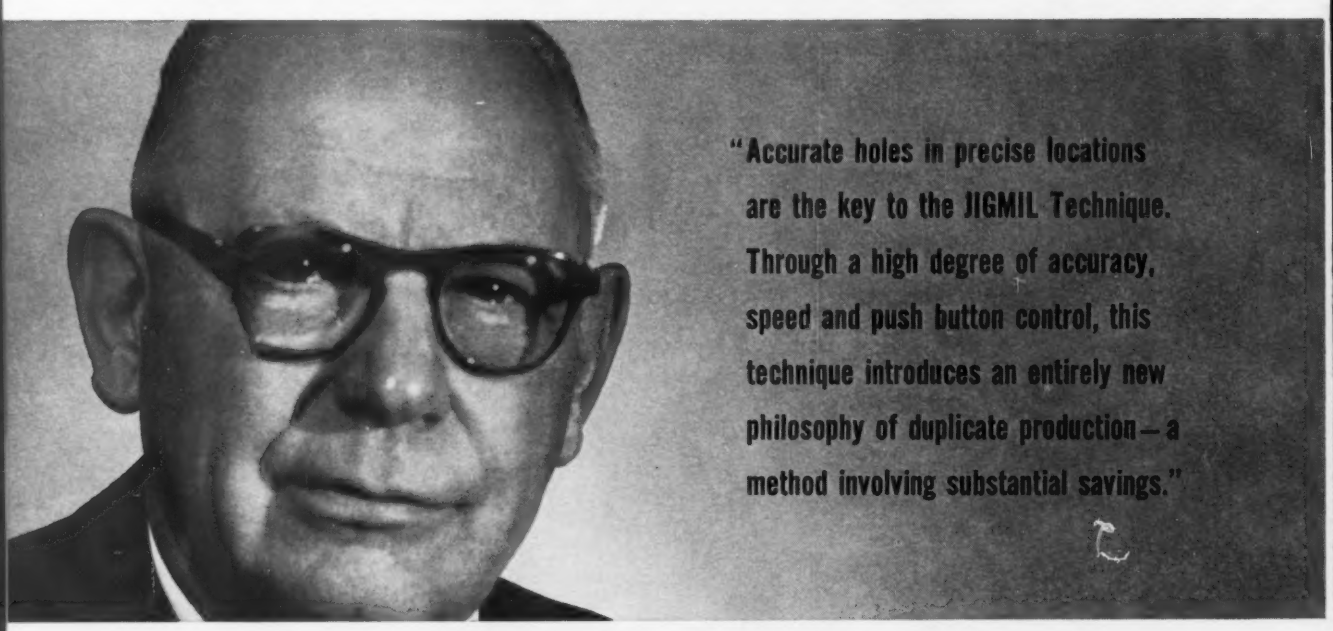
32 Years of Special Machine Tools with Automation

Several Semi-Standard Machines with Steering Knuckles for British Car Builder



BEFORE THEY COME TO FAIR STREET

They tell us we are exaggerating . . .



"Accurate holes in precise locations are the key to the JIGMIL Technique. Through a high degree of accuracy, speed and push button control, this technique introduces an entirely new philosophy of duplicate production—a method involving substantial savings."

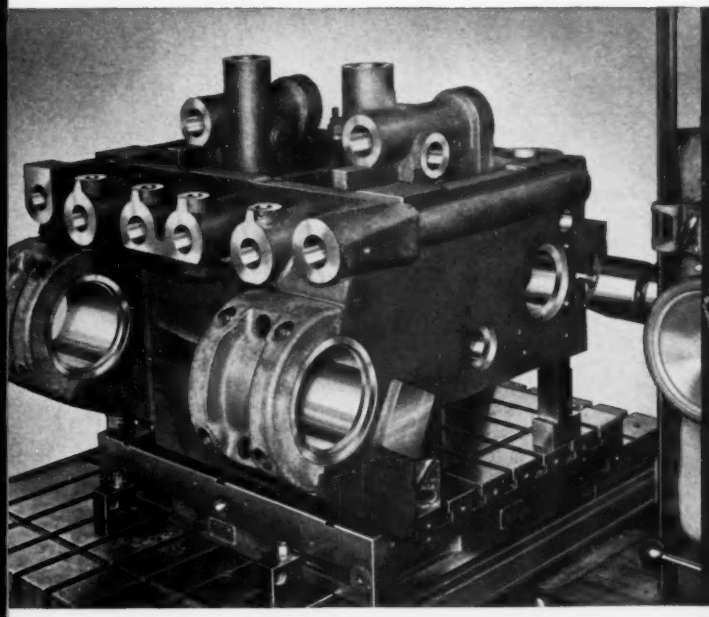
If we sat down across the desk from you and explained what we had done with the JIGMIL Technique in boring and milling parts similar to your own, the chances are you wouldn't believe us. Few people do. But we don't blame them. The JIGMIL Technique sounds too visionary. Savings seem too great. *Although simple, the* JIGMIL *Technique is so revolutionary that you have to see it to believe it.* Will you come to Fair Street (home of the JIGMIL) and see for yourself? We would be delighted to have you.

C. B. DE VLIEG

DE VLIEG MACHINE COMPANY 450 FAIR STREET

Some of Our Users in the Machine Tool Industry

Avey Drilling Machine Co.
Barber-Colman Company
E. W. Bliss Company
Brown & Sharpe Mfg. Co.
Buhr Machine Tool Co.
Cincinnati Milling Machine Co.
Cincinnati Shaper Co.
Cleveland Hobbing Machine Co.
Cross Company
Ex-Cell-O Corporation
Foote-Burt Company
Gallmeyer & Livingston Co.
Gisholt Machine Co.
Gleason Works
Gould & Eberhardt, Inc.
G. A. Gray Company
Hamilton Tool Co.
Heald Machine Co.
Ingersoll Milling Machine Co.
Jones & Lamson Machine Co.
Kearney & Trecker Corp.
King Machine Tool Div.
Landis Tool Co.
Landis Machine Co.
R. K. LeBlond Machine Tool Co
Lees-Bradner Co.
Lodge & Shipley Co.



A FEW PROVEN ADVANTAGES OF THE JIGMIL TECHNIQUE

- Eliminates cost of expensive jigs and production delays resulting from their manufacture.
- Simplifies tooling.
- Employs automatic functions to reduce factors of human error . . . even in close tolerance work.
- Makes possible greater flexibility of product design.
- Improves end product by permitting interchangeable assembly of parts without hand fitting.
- Increases production and product accuracy.

ACCURACY IS AN ECONOMY!

A TYPICAL EXAMPLE OF JIGMIL ECONOMY

At one setting! On four sides! Without the aid of jigs! This horizontal broaching fixture was completely machined—*bored* and *milled* to precise limits of accuracy. The JIGMIL Technique requires a minimum of tooling and technical skill to produce precision parts.

Micromatic Hone Corp.
Monarch Machine Tool Co.
Moore Special Tool Co., Inc.
National Acme Co.
National Automatic Tool Co., Inc.
National Broach & Machine Co.
National Machinery Co.
Oilgear Co.
Sheffield Corporation
Snyder Tool and Engineering Co.
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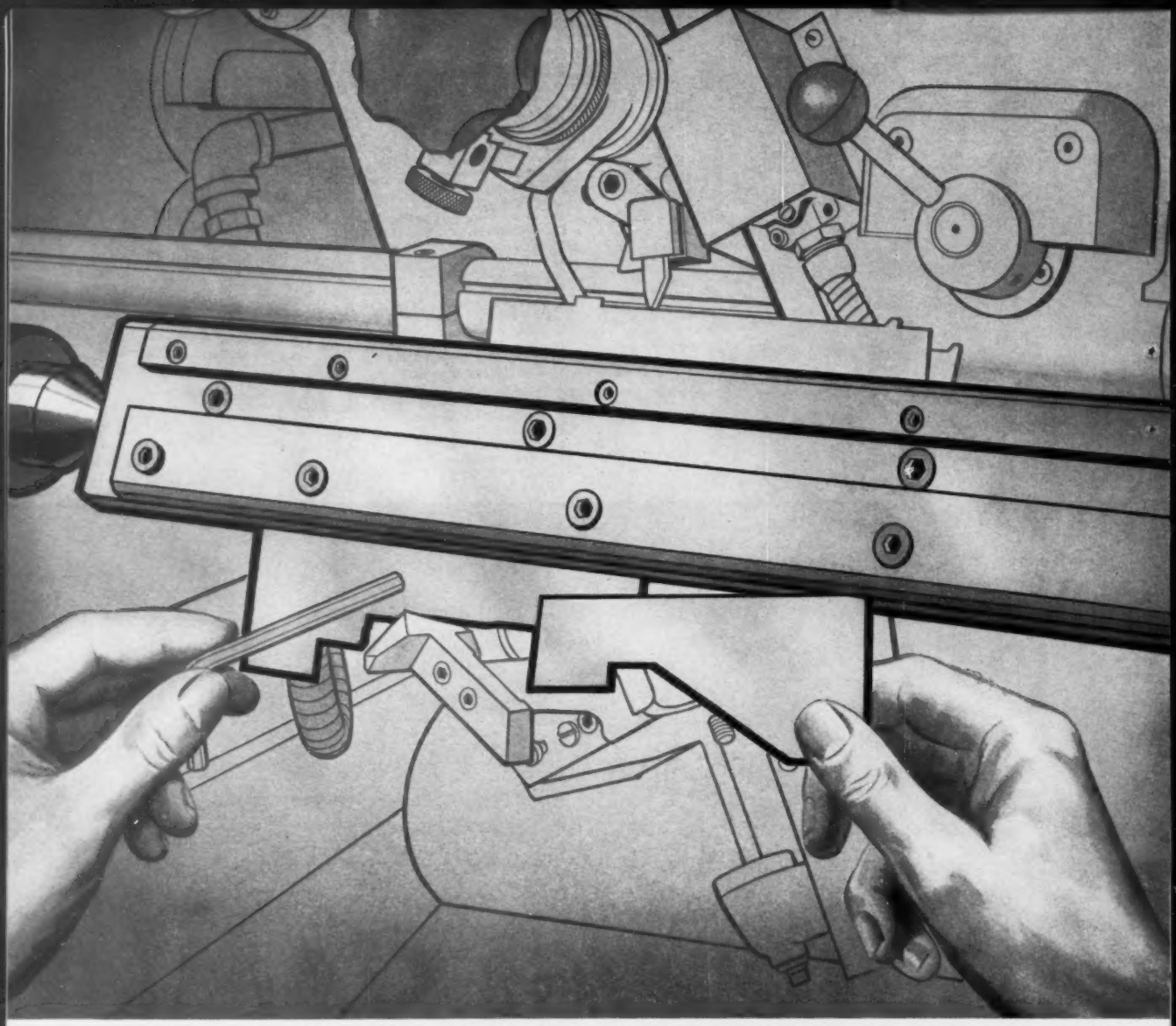
SPIRAMATIC JIGMILS®

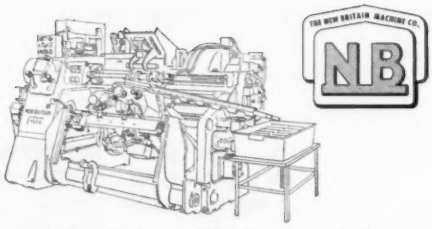
ACCURATE HOLES IN PRECISE LOCATIONS



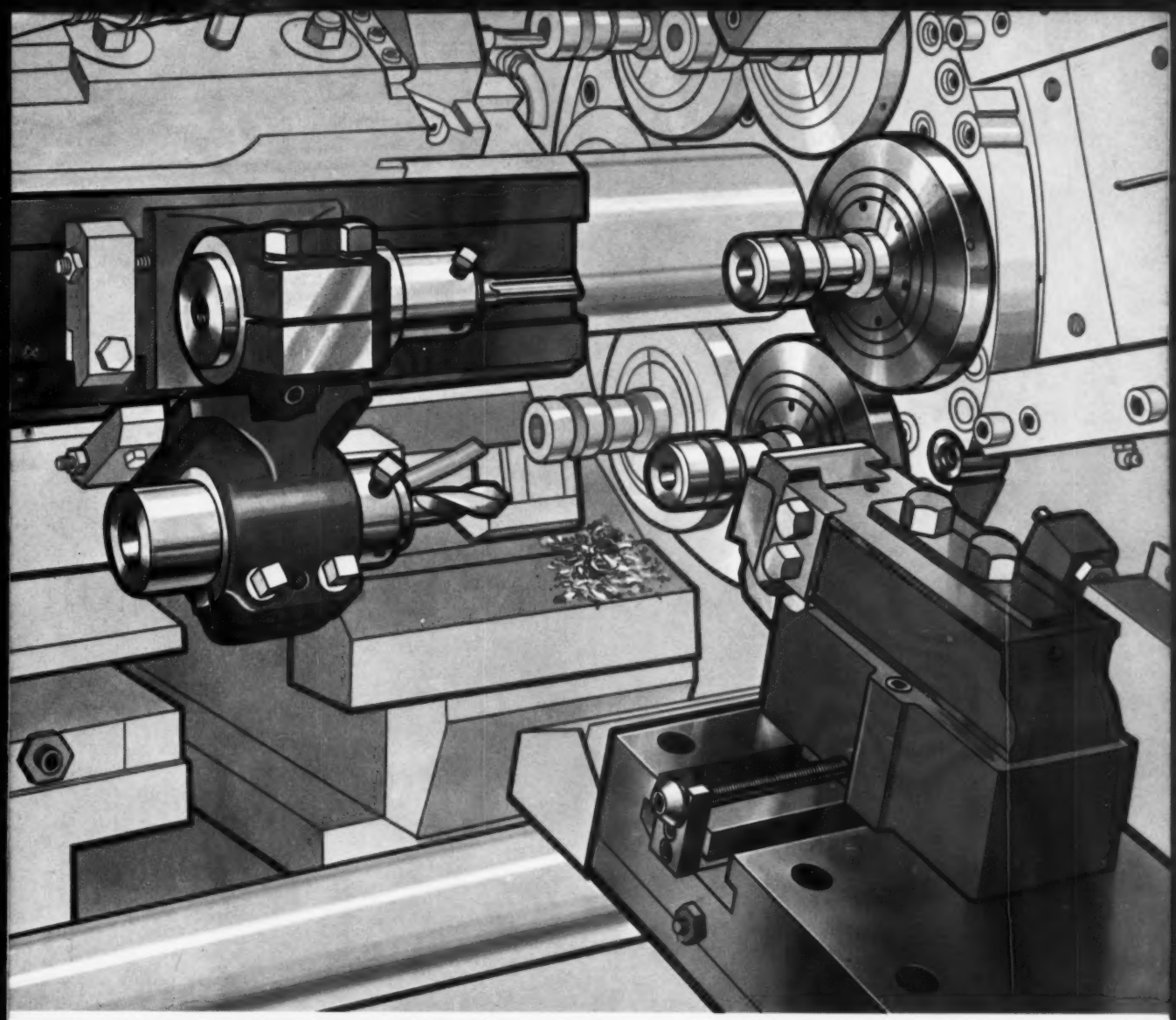
template control "locks in your dimensions"

on New Britain +GF+ copying lathes

When you fasten the template on a New Britain +GF+ you lock in every dimension of the piece. The complex settings necessary in gang tooling setups simply don't exist. You change the tool in the time it takes to loosen one set screw. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

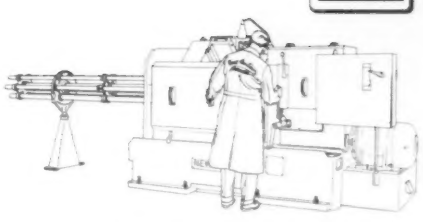


New Britain +GF+ Copying Lathe

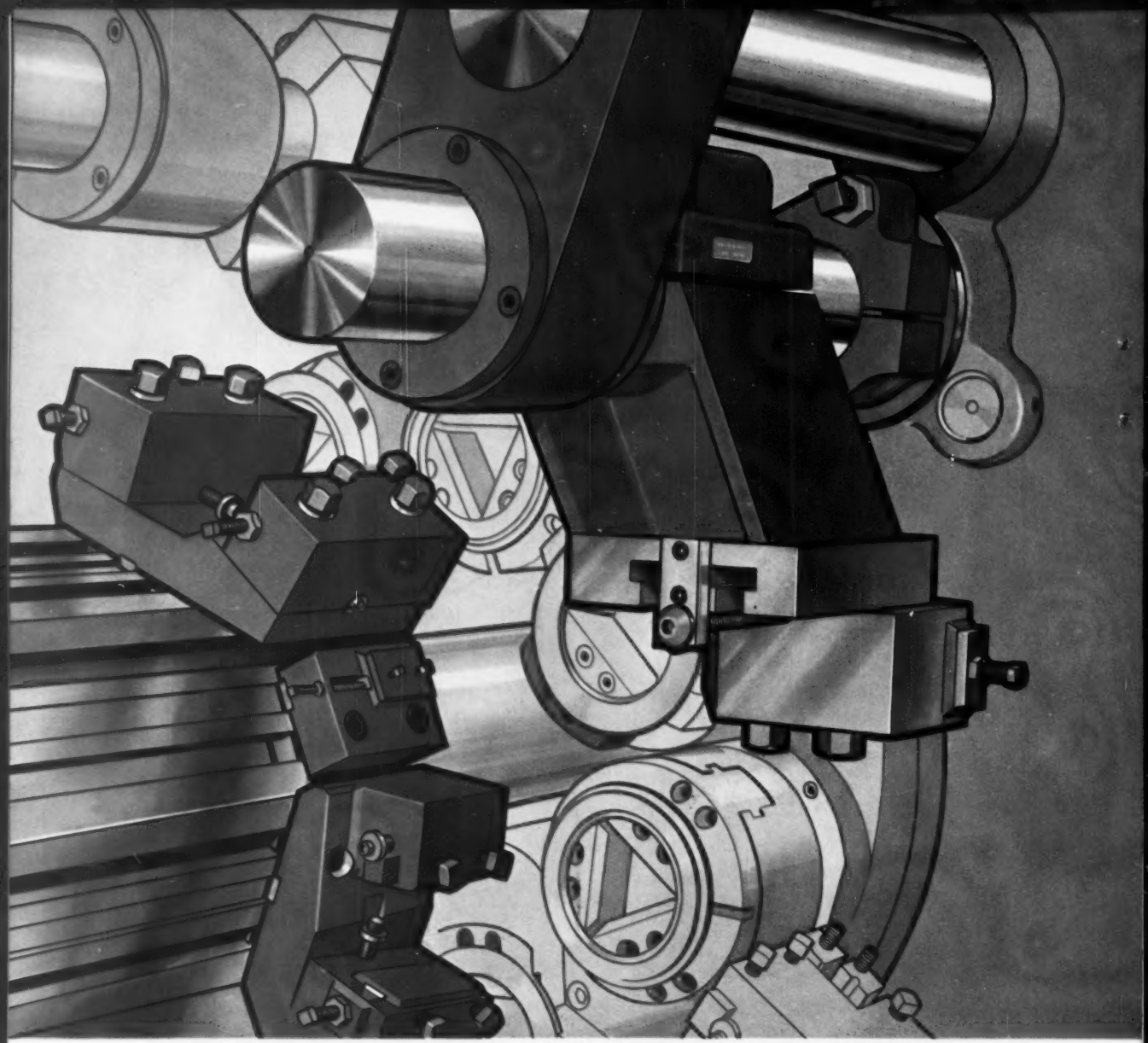


less wear means more profit

New Britain bar machines are "built to stay accurate." Hardened spindle nose cross slides, eccentric cross slide stop buttons and tool slides, plus carrier lifting during index, are only a few of many *exclusive* New Britain features for preserving long-run accuracy. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



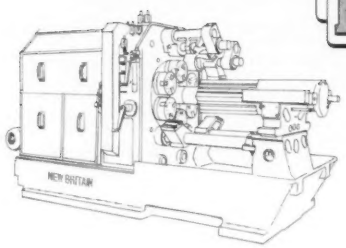
Automatic Bar Machine



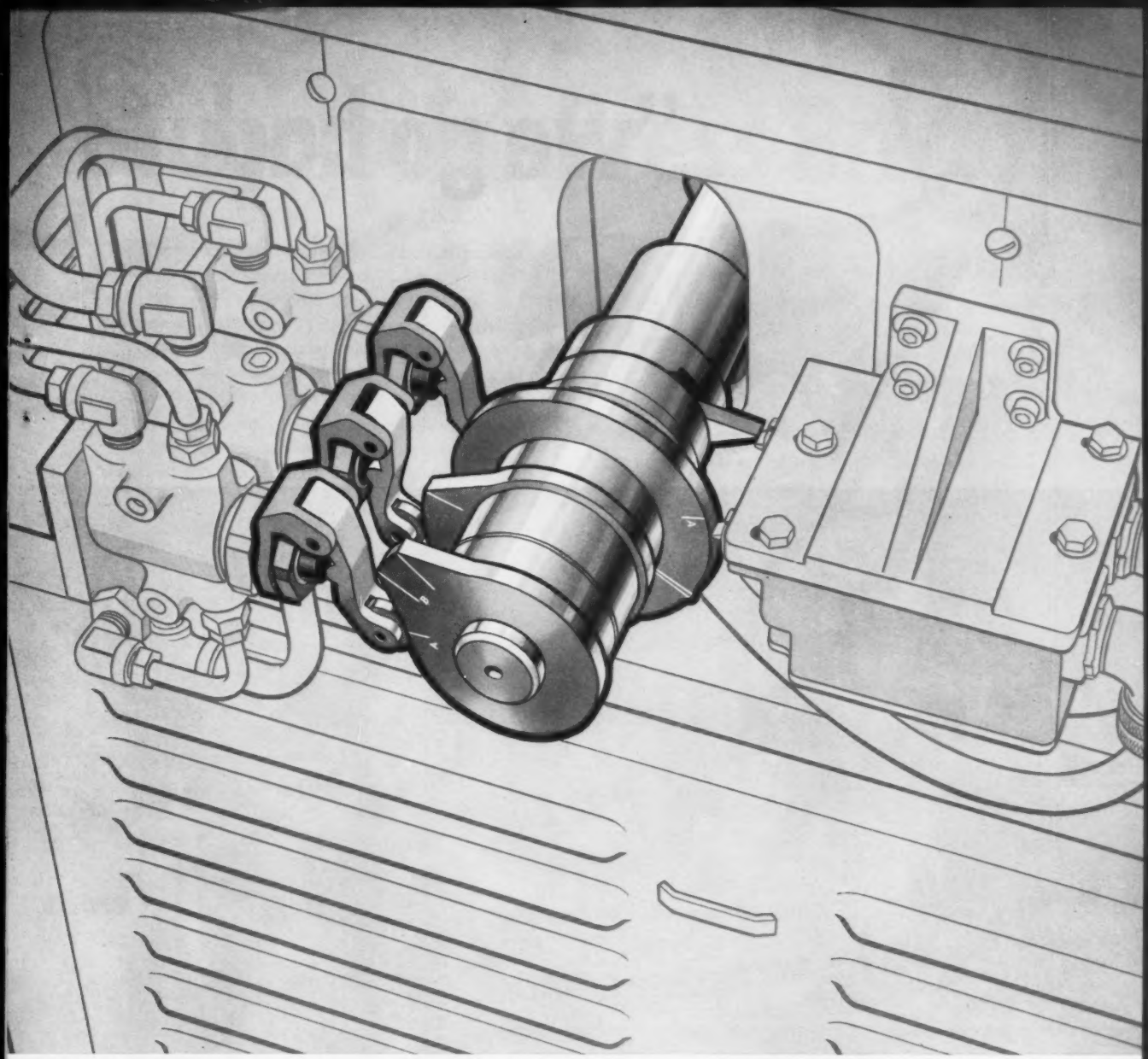
when the job calls for a big, husky chucker

pick a New Britain

New Britains are massive, not only in over-all size and weight, but in every individual feature. Rugged forming arms and tool slides transmit smooth power to the cutting edge in every position. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Automatic Chucking Machine



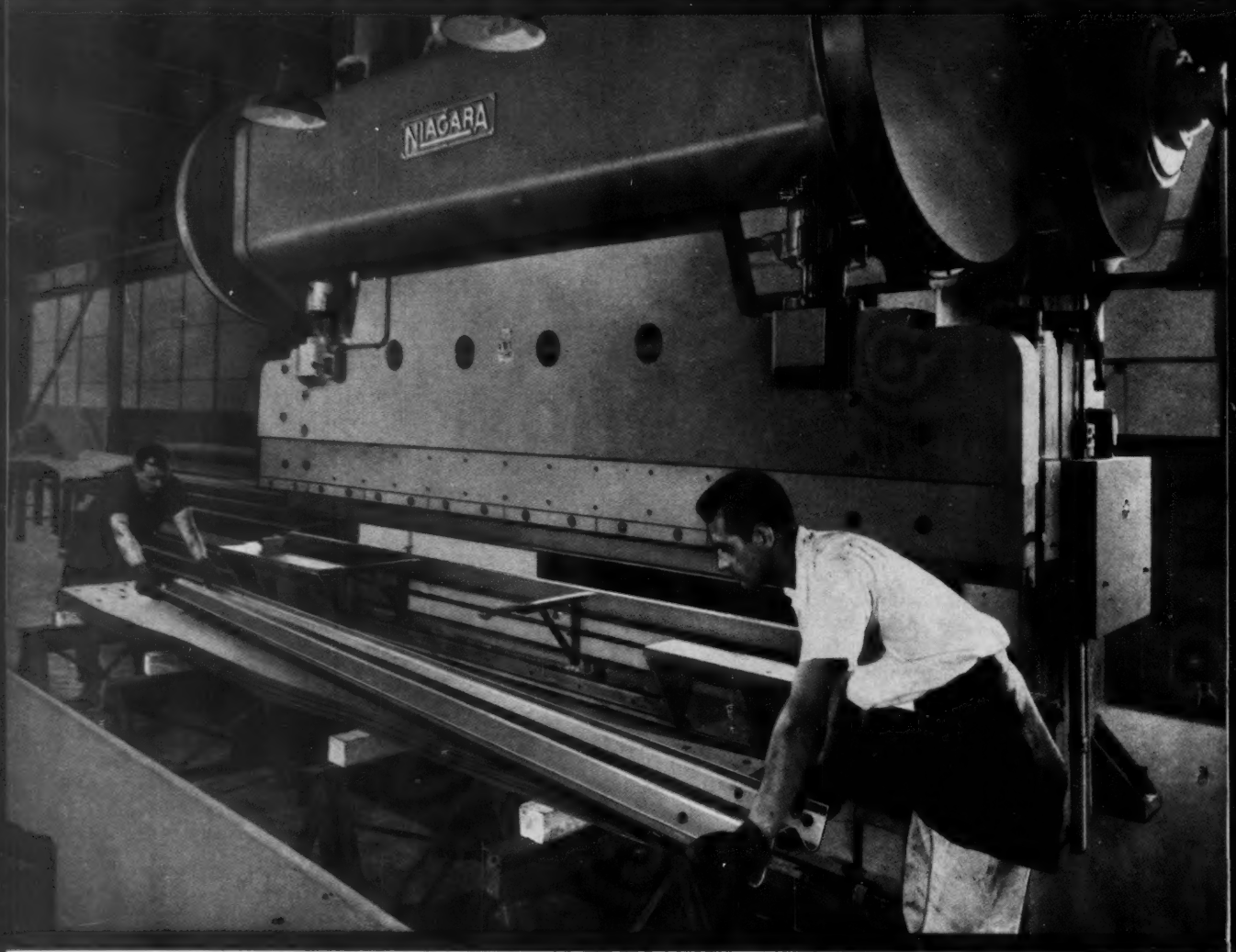
New Britain boring machines feature exclusive mechanical program control

This New Britain feature means *positive control* which, in turn, means fewer mistakes, fewer rejects, and fully automatic operation, if desirable. Geared to the main cam shaft, it operates the sequence of operations, both electrical and pneumatic.

Combined with positive, accurate cam control of the tool slides, mechanical program control makes a New Britain boring machine your most dependable, accurate, and profitable investment for straight or contour boring and turning. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

Precision Boring Machine

"we go back to



(Above) Forming highway guard rails from 12 gage steel on Niagara 520 Ton Press Brake.

(Right) Piercing rails with same machine.

(Far Right) Forming chair seat frames for office furniture from 20 gage steel on Niagara 150 Ton Press Brake.

Niagara for Press Brakes"

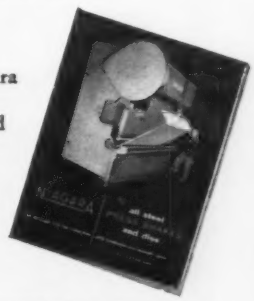
"The personnel of our organization has been acquainted with Niagara equipment for years. Niagara will stand behind *any* equipment furnished. Many millions of operations in the past 5 years on their presses and press brakes ... equipment satisfactory from both the operational and safety standpoint. Our intention is to use the Niagara line entirely."

There in the words of one customer (a large Ohio metal fabricator whose press brake operations are illustrated), you have the sentiments of hundreds. Once experienced with *any* of the other metalworking machines which Niagara makes ... presses, shears, bending rolls and dozens more ... one just naturally thinks first of Niagara whenever the subject of press brakes comes up.

REASONS ARE MANIFOLD: (1) Extreme helpfulness of Niagara's engineers in selecting the machine and accessories that will do the job best (no other manufacturer can offer so complete and large a line of sheet and plate metalworking equipment). (2) Unrivaled reputation and experience in the field, dating back 77 years, that assure unquestioned reliability. (3) World-wide recognition for design leadership, combining rock-bottom operating economy and top-notch performance in *every* product it makes (take a moment to run down this partial list of imposing press brake features):

- *Double end twin drive with double reduction gearing for smooth, uniform application of power at both ends of ram.*
- *Rugged, all-steel frames with box type crowns of unequaled strength and rigidity.*
- *Extra heavy, rigid bed and ram for maximum support of dies.*
- *Gearing totally enclosed in sealed oil baths for thorough, clean lubrication.*
- *Longer lasting, laminated, nonmetallic ways.*
- *Powerful, smooth-acting, multiple disc clutch and brake.*
- *Gibs maintain accurate, endwise alignment of ram.*

Standardized in a complete line, ranging from 50 through 775-ton capacities, Niagara Press Brakes are built to produce a tremendous variety of work uniformly and accurately. Post yourself now on all the details by requesting Bulletin 89 D and, as soon as you can, avail yourself of some really worthwhile suggestions from a Niagara representative. Write.



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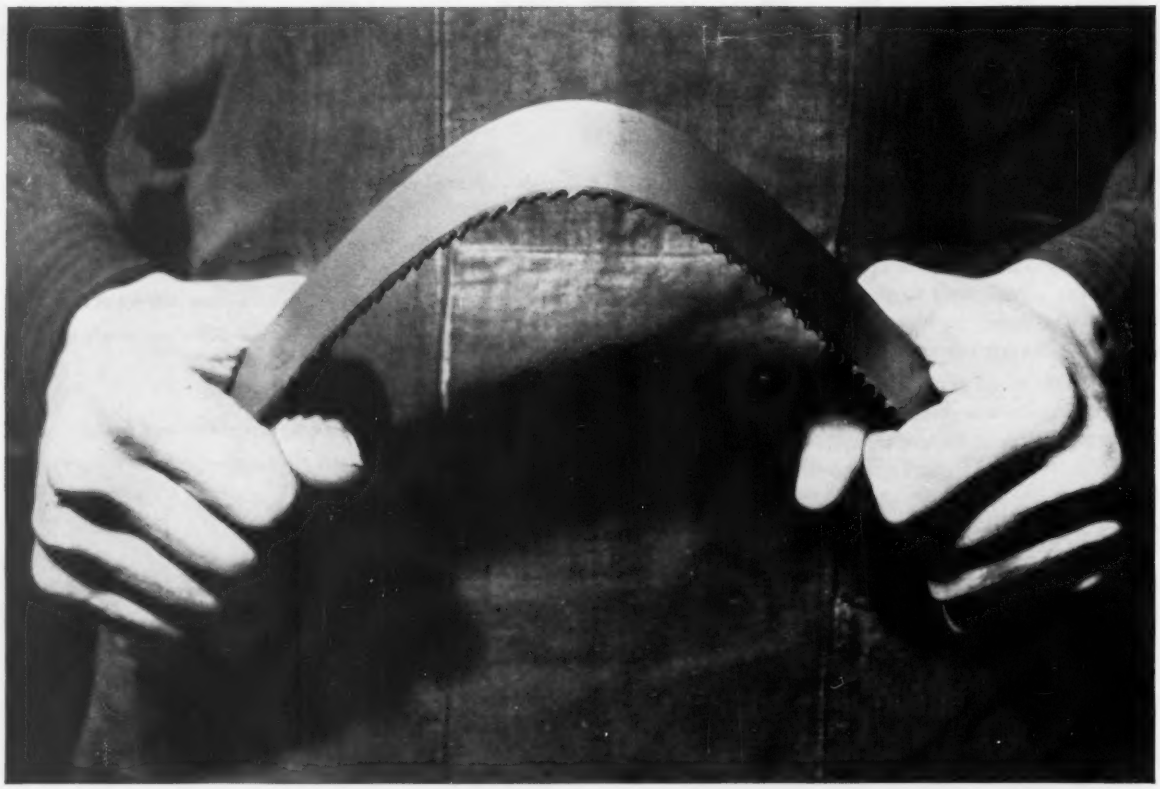
America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work

NIAGARA PRESS BRAKES



THIS is No Ordinary Power Hack Saw Blade

This is the *unbreakable* MARVEL High-Speed-Edge Hack Saw Blade—the first bi-metal blade—invented, developed and introduced by MARVEL. This blade is a combination of two materials best suited to the requirements of an efficient hack saw blade . . . a narrow high speed steel cutting edge permanently welded to a tough, non-brittle alloy steel body. Each blade is triple tempered to assure long life and maximum toughness to the cutting edge. Development of this high-speed-edge blade made it possible to cut any kind of material from the free machining steels to the toughest of alloys, fast, accurately and economically. Just one type blade to handle any job — no switching blades to cut different materials. Like all good things, attempted copies of this blade have been numerous, but its performance has been *unequalled* by any of the imitators.

The MARVEL high-speed-edge hack saw blade can be tensioned from 200% to 300% tauter than any ordinary hack saw blade, a definite advantage which permits heavier feed pressures to be used without deflection or fear of breakage.

An extremely rugged cutting tool, this one type blade, the MARVEL High-Speed-Edge Hack Saw Blade, will cut any machineable metal with outstanding economy, accuracy, long life and complete safety—*it is unbreakable.*

Ask for MARVEL Blades by name and you can be sure you're getting the best on the market. Leading Industrial Distributors have them in stock.

B-1120

Write for latest cutting tool Bulletin and the name of your nearest MARVEL Distributor

MARVEL Metal Cutting SAWS
Better Machines—Better Blades

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For more information fill in page number on Inquiry Card, on page 241

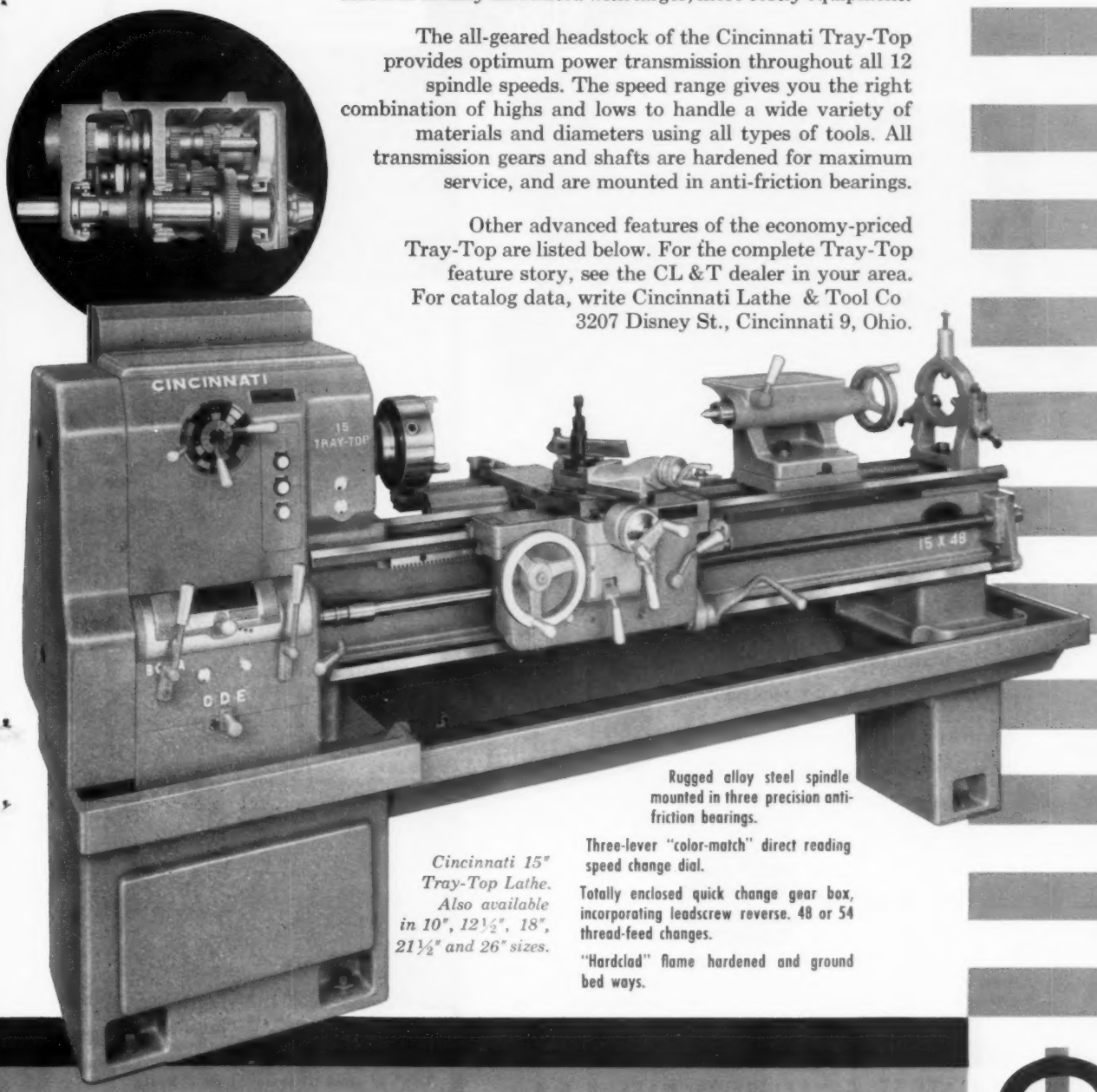
better performance... greater value... are built into

CINCINNATI
TRAY-TOP LATHES

World-famous "Cincinnati" design and engineering are fully reflected in the new Tray-Top Lathes. They incorporate precision workmanship and quality features usually associated with larger, more costly equipment.

The all-geared headstock of the Cincinnati Tray-Top provides optimum power transmission throughout all 12 spindle speeds. The speed range gives you the right combination of highs and lows to handle a wide variety of materials and diameters using all types of tools. All transmission gears and shafts are hardened for maximum service, and are mounted in anti-friction bearings.

Other advanced features of the economy-priced Tray-Top are listed below. For the complete Tray-Top feature story, see the CL &T dealer in your area. For catalog data, write Cincinnati Lathe & Tool Co 3207 Disney St., Cincinnati 9, Ohio.



Cincinnati 15" Tray-Top Lathe. Also available in 10", 12½", 18", 21½" and 26" sizes.

Rugged alloy steel spindle mounted in three precision anti-friction bearings.

Three-lever "color-match" direct reading speed change dial.

Totally enclosed quick change gear box, incorporating leadscrew reverse. 48 or 54 thread-feed changes.

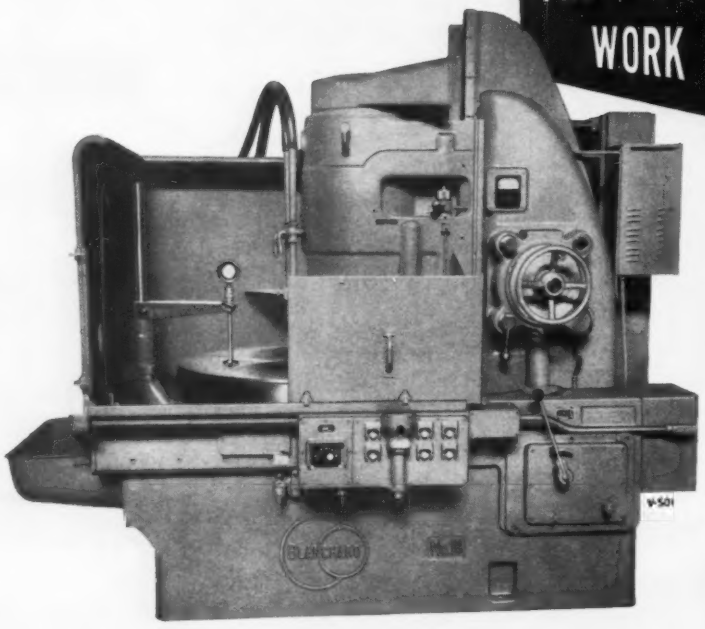
"Hardclad" flame hardened and ground bed ways.

center on **cincinnati lathes and drills**

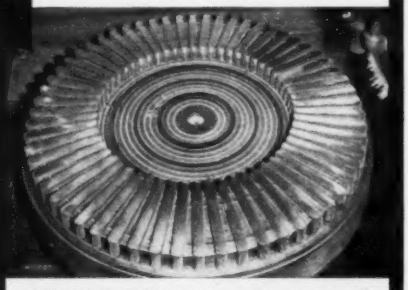
Builders of Engine, Toolroom, and Fixed Gap Bed Lathes and a Complete Line of Drilling Machines

for BEST results in surface grinding...
PUT IT ON THE BLANCHARD

PRODUCTION WORK

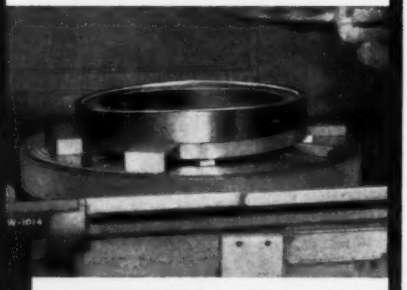


SIDE PLATES. 9" x 18" plates ground from rough on No. 18 Blanchard with 36" chuck. Stock removal 1/16" to 1/8" per side. Held flat within .003", parallel to .001", and to dimension tolerance of ±.001". Production: 30 surfaces per hour.

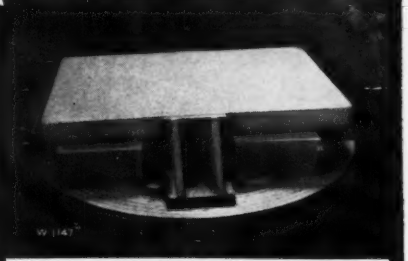


CONNECTING LEVERS. Cast iron levers ground in special magnetic fixture with pins located in "vee's". Stock removal per side is 1/32" to 1/16"; must be flat and at right angles to pins. No. 18 production: 180 pieces per hour, compared to 20 pieces per hour by former method used.

MAINTENANCE AND ODD LOT WORK



HARDENED STEEL PUNCHES. This 24-13/16" dia. punch, reground on a No. 18, is centered radially on 36" magnetic chuck. Duplicate circumferential and radial shear reliefs are generated with two setups.



GRANITE SURFACE PLATES. A No. 18 Blanchard reconditions this 18" x 34" granite surface plate by grinding it flat within .0002". 3/16" of stock is removed in 5 hours.

Blanchard Grinders are used throughout industry on surface grinding jobs that demand the utmost in production, finish and accuracy.

Whatever *you're* surface grinding, there's a Blanchard designed to do the job speedily and accurately.

PUT IT ON THE **BLANCHARD**

Send for free copies of "Work done on the Blanchard", fifth edition, and "The Art of Blanchard Surface Grinding".

THE BLANCHARD MACHINE COMPANY
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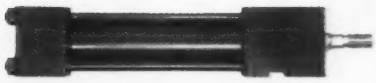
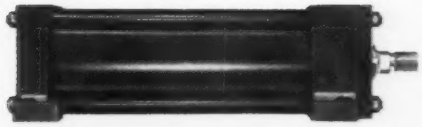


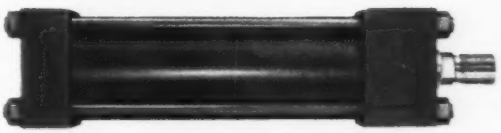


Five cylinder series... each the best of its kind!

Here you see one more reason why experienced cylinder users prefer Hannifin cylinders...there is a Hannifin cylinder series for every type of service.

What pictures cannot show you is the extra effort that goes into every Hannifin cylinder, all the way from the drawing board to the shipping dock. This brings you design features other cylinders simply do not have...superior workmanship where it's most needed for long, trouble-free service...and better delivery promises, better kept. All at prices no higher than you may have been paying for less satisfactory cylinders.

There's a Hannifin man near you—or, if the need is urgent, call us long distance. He or we will welcome the opportunity to help you as you select the Hannifin cylinder series that best meets your needs.



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HANNIFIN

POWER CYLINDERS

COMPLETE CYLINDER FILE

Write for your copy of this new Hannifin Cylinder File...complete, easy-to-use, easy-to-order-from information on five lines of Hannifin cylinders. Write Hannifin Corporation, 509 S. Wolf Road, Des Plaines, Illinois.

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SHAPERS

BUILT TO U.S. STANDARDS BY EUROPE'S FINEST CRAFTSMEN

The finest old world skills build life-long precision into these shapers assuring dependable production to the most exacting tolerances. Sound engineering standards and modern design are combined in these shapers offered at low initial cost.

5" VERTICAL

Chomienne Vertical Shaper—
5" stroke, with 12½" rotary table, automatic lubrication, power feed. A real time-saver for accurate machining of irregular shapes and forms. Low initial cost.

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VMA Shapers—standard and production models . . 14" to 28" stroke . . automatic lubrication, table power rapid traverse.

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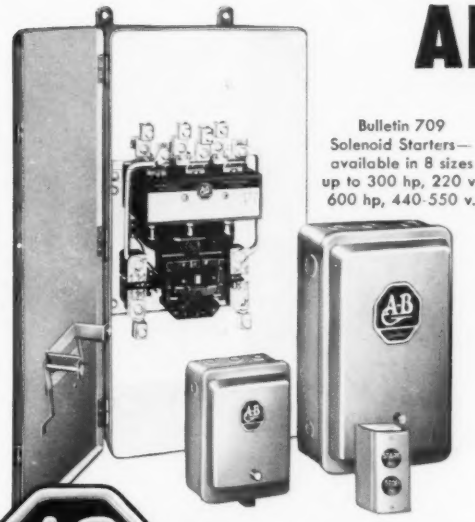
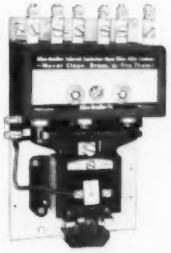
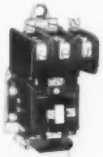


Bulletin 709
Solenoid Starters—
available in 8 sizes
up to 300 hp, 220 v;
600 hp, 440-550 v.

A-B Quality



Bulletin 702
Solenoid Contactor
Size 3



Bulletin 702
Solenoid Contactor
Size 1

Bulletin 700
Solenoid Relay

Bulletin 800T
Oiltight Push Button

Bulletin 800T
Oiltight Selector Switch

Among leading manufacturers of machine tools, Allen-Bradley Quality motor starters are the favorite—as shown by many independent preference studies. Having the Allen-Bradley Quality trademark appear on your equipment means automatic customer acceptance.

The "simple design" of Allen-Bradley motor control . . . with only *one* moving part . . . guarantees reliable operation. The double break, silver alloy contacts—used in all Allen-Bradley controls—are always in perfect operating condition. Even inspection time—let alone maintenance time—is saved.

No matter what your control requirements may be, they can be met with standard components listed in the Allen-Bradley Handy Catalog . . . Allen-Bradley control specialists can help you with your control problems. *Standardize* on Allen-Bradley Quality motor control . . . add this sales asset to your production machines!

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

5-57-R

for reliability...plus consistent operation

SPECIFY Allen-Bradley

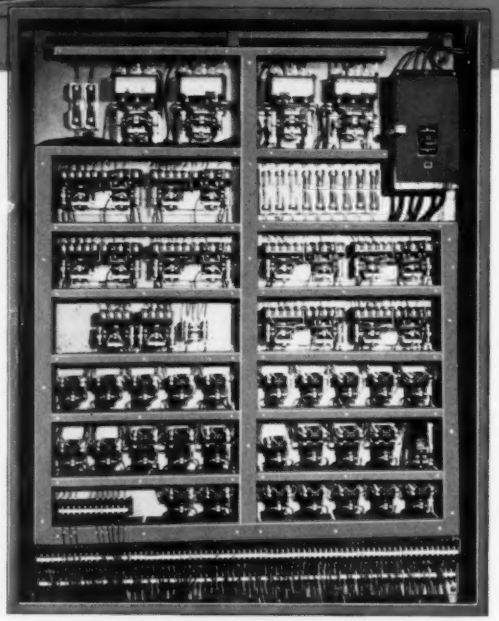
BARNESDRIL
Duplex type honing machine, for honing V-8 motor blocks, equipped with a special Allen-Bradley control panel.

The motor controls on your automatic machines must be reliable when the machines are new . . . and remain reliable when the machines are old. When the sequence of operations is short, the controls must be instantaneous and consistent in their operation . . . or production has to be slowed down to the maximum variation in time of contactor operation. Sluggishness of a single component . . . even for a split second . . . may mean costly repairs and work spoilage.

Reliability is an integral part of all A-B motor controls. The simple solenoid design . . . with only one moving part . . . assures millions of trouble free operations. The double break, silver alloy contacts never need service attention.

Let Allen-Bradley help you with your special control problems. As you know, "quality" and "cheap" are two "teams" never in the same league.

Please send for the new Allen-Bradley Handy Catalog.



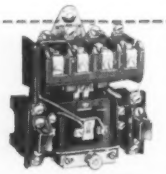
Motor control panel for a Barnesdril honing machine made from standard Allen-Bradley control units listed in the Allen-Bradley Handy Catalog.

5-57-R

A-B Quality

BULLETIN 849
"On-Delay"
Pneumatic Timer

BULLETIN 802T
Adjustable Lever
Oiltight Limit Switch



BULLETIN 709
Automatic
Solenoid Starter

BULLETIN 700
Universal Type
Solenoid Relay

BULLETIN 800T
Oiltight Push Button
Station

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

an interesting statement from KOEHRING COMPANY concerning equipment replacement in multi-plant operation

by

Julien R. Steelman

President and General Manager

"Koehring Company and Subsidiaries operate manufacturing facilities at 10 locations in the United States and Canada. Known traditionally as a manufacturer of a diversified line of construction machinery, Koehring, through its Hydraulic Press Manufacturing Division, also manufacture metal working hydraulic components as well as, through its Canadian plant, equipment for the pulp and paper industry.

"In the early history of the company under owner-management at the company's only plant, capital equipment needs could be, and frequently were, determined by the president. On occasion shop superintendents and general foremen, for example, did not know what equipment may have been purchased, if any, until they lifted the canvas cover of an incoming shipment of a new machine tool for their work. From these early stages, growth of the company as well as progress throughout industry in the concepts of industrial management have led to the formalization of equipment replacement practices. Recently we have modified our replacement analysis program similar to that of the M.A.P.I.

"The general-purpose equipment we require for our manufacturing usually involves low obsolescence and a long useful life. However, the compelling need and the desire to find better ways of accomplishing our work require close attention to equipment replacement analysis. Naturally, better methods frequently involve machine replacements.

"The initial request for new capital equipment now originates at each location with the shop management, which is encouraged to be alert to profitable replacement opportunities. Replacement analyses are made by industrial engineering personnel at each location and final decision as to size, type and manufacturer are made by those directly responsible for production. Decisions as to the total amount of appropriation to be authorized for any plant or for all of the plants together require broader economic considerations and involve discussions and approval by the board of directors.

"With multi-plant operations we believe a formal approach to equipment replacement helps provide management with assurance that equipment is being replaced on a timely basis and that as alternate uses for available capital funds occur, those most likely to produce the highest return will receive priority."

Rockford Insert Group

May, 1957

keep gathering metal-working production ideas . . . be well informed when you replace machinery . . . . . .

it takes top cutter design to get best cutter performance!

BARBER-COLMAN offers

Special Form Development

Special form-relieved cutters often allow several operations to be combined into one. Barber-Colman Engineers are experts in designing special tooth forms on form-relieved cutters for solving specific milling problems.

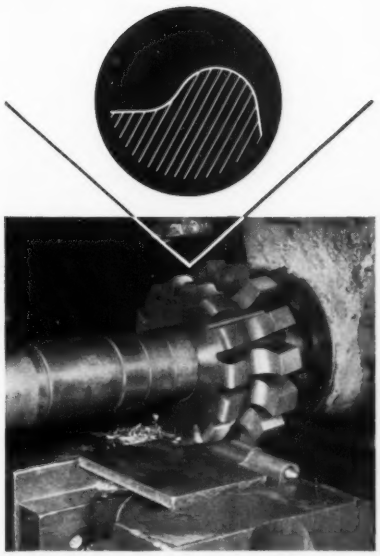
Our cutting tool division has the complete engineering, manufacturing and inspection facilities for making specially-designed form-relieved cutting tools of the finest quality. In addition to designing special forms, our engineers will design into the cutter such special features as axial side clearance, rake angles and helical flutes in any combination to produce maximum cutting efficiency. The best high-speed steel for the specific material to be cut is specified by our experienced engineering staff.

Barber-Colman form-relieved cutters require no "spot sharpening". Accurate face sharpening will maintain the correct form for the life of the cutter. This is true on all cutters including those with axial relief, rake or helical flutes.

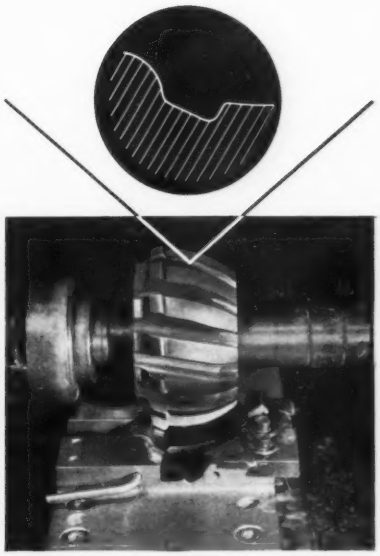
Application of Axial Relief

Surfaces which are in a plane perpendicular to the axis of the cutter, or nearly perpendicular, cannot be milled with a form-relieved cutter unless the cutter teeth are provided with axial side clearance. Barber-Colman can solve this problem by making the cutter with axial relief in one or both directions so that several cuts can be combined into a single milling operation. These applications show the proper use of axial clearance and helical flutes.

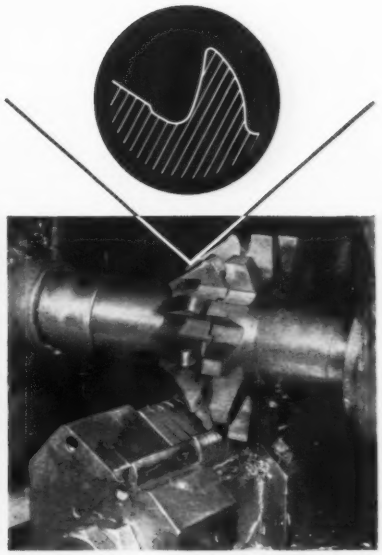
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



The form on this part has one side which is nearly perpendicular to the axis of the cutter, requiring a cutter with axial relief as well as radial relief. Both the axial and radial relief are formed onto the cutter tooth at the same time, and they are both applied to the complete tooth form. Consequently, the faces of the teeth can be sharpened without changing the tooth form. Helical flutes are provided to produce a shearing cut for improved finish and cutter life.



The form on this cutter is provided with both radial and axial relief because one small section of the form is nearly perpendicular to the cutter axis. Without axial relief, the perpendicular portion of the form would wear rapidly because of insufficient clearance. However, since the entire form has ample clearance behind the cutting edge, cutter life is greatly improved. Helical flutes eliminate any chatter during the cutting operation.



The workpiece in this application is tipped at an angle so that there is no undercut portion in relation to the axis of the cutter. However, in its cutting position, both sides of the form are nearly perpendicular to the cutter axis. The cutter is a two-piece interlocking type with axial relief in one direction on one side of the form, and in the other direction on the other side of the form. As the cutter is sharpened the form spreads apart, but the correct shape of the form is maintained. The proper dimensional relationship between the form is maintained by simply grinding the spacer between the two sections to the proper thickness.

These are only a few examples of the many special cutter problems passing through our Engineering Department daily. We welcome the opportunity to work with you in solving your production problems, and we invite you to send us part prints. Get top cutting efficiency through top cutter design.

BARBER-COLMAN COMPANY

825 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

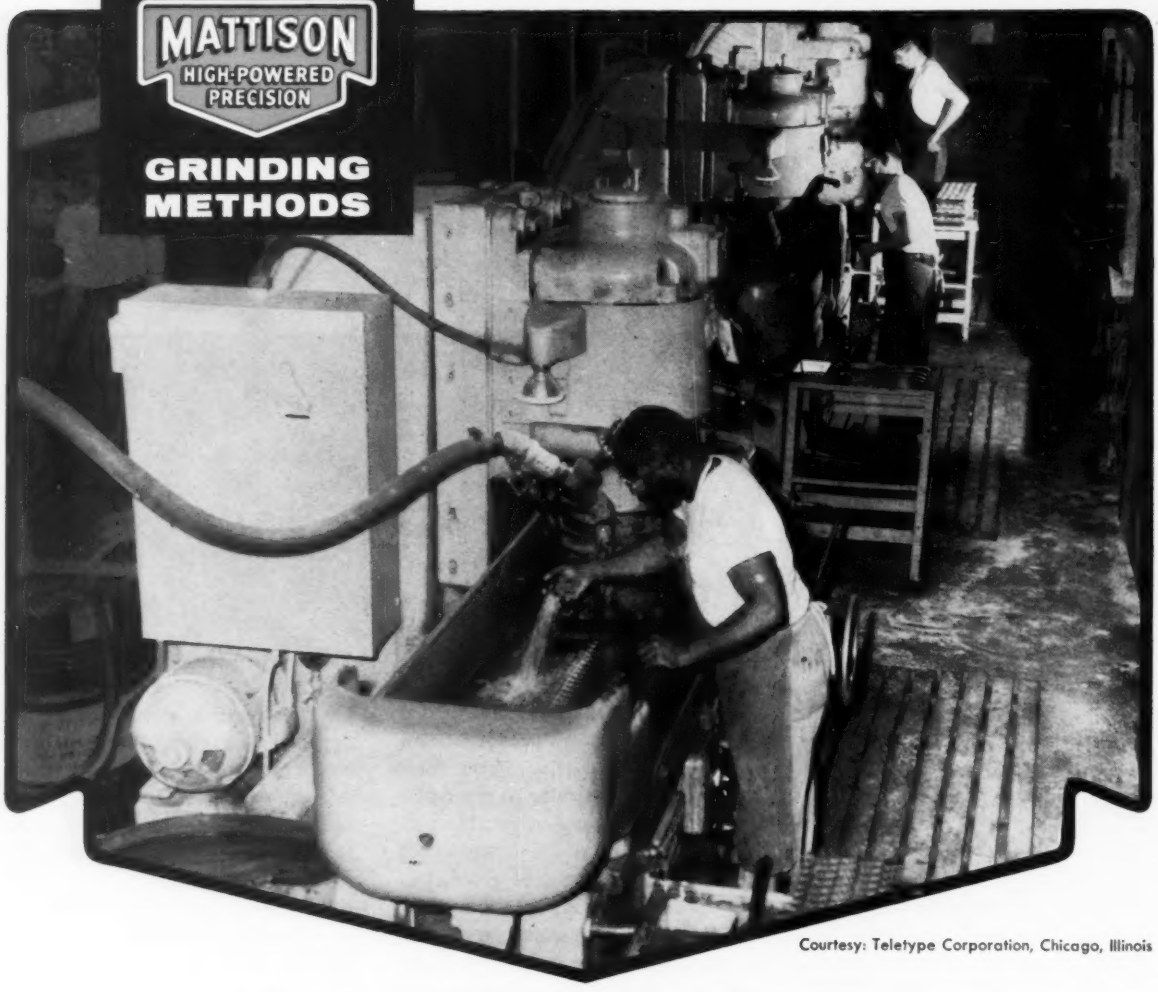
BARBER COLMAN

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 39—SMALL STEEL PARTS

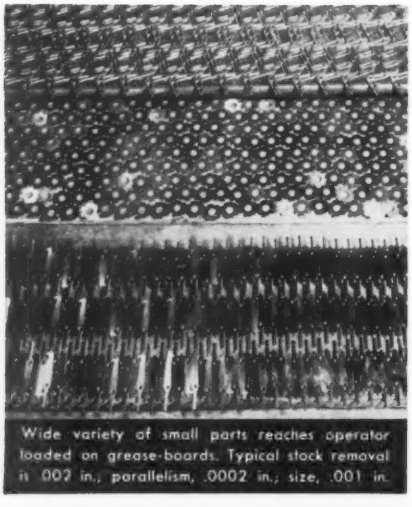
MATTISON
HIGH-POWERED
PRECISION

GRINDING METHODS



Courtesy: Teletype Corporation, Chicago, Illinois

Grease-board loading, high-powered surface grinders speed production of precision small parts

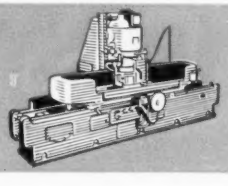


Wide variety of small parts reaches operator loaded on grease-boards. Typical stock removal is .002 in.; parallelism, .0002 in.; size, .001 in.

Vital stamped steel parts are finish-ground to close tolerances at rates up to 700 per hour, by the Teletype Corp., Chicago, Ill. Use of grease-board loading and high-powered Mattison Vertical Spindle Surface Grinders makes this performance possible.

Over 2,000 varieties of parts are ground on three heavy Mattison machines. Most are moving components of sensitive communication and tabulating machines. Boards with 100 or more pieces held with axle grease are delivered to each operator. He reverses the board on the magnetic chuck to quickly load the grinder . . . greatly reducing setup time. Parts are loaded on the boards right from the punch presses. Two of the Mattison grinders used in this plant have been in service for ten years and the third for six . . . without a shutdown for major maintenance. They are presently used 16 to 18 hours a day, 6 days a week, holding tolerances on production runs to .0002 in. The heavy base and column construction, longer V and flat ways for both head and table, and over-all rigidity of Mattison Vertical Spindle Surface Grinders make this heavy-duty repetitive grinding possible. See your Mattison dealer for full details.

IF IT'S A FLAT SURFACE
THERE IS A MATTISON
TO GRIND IT

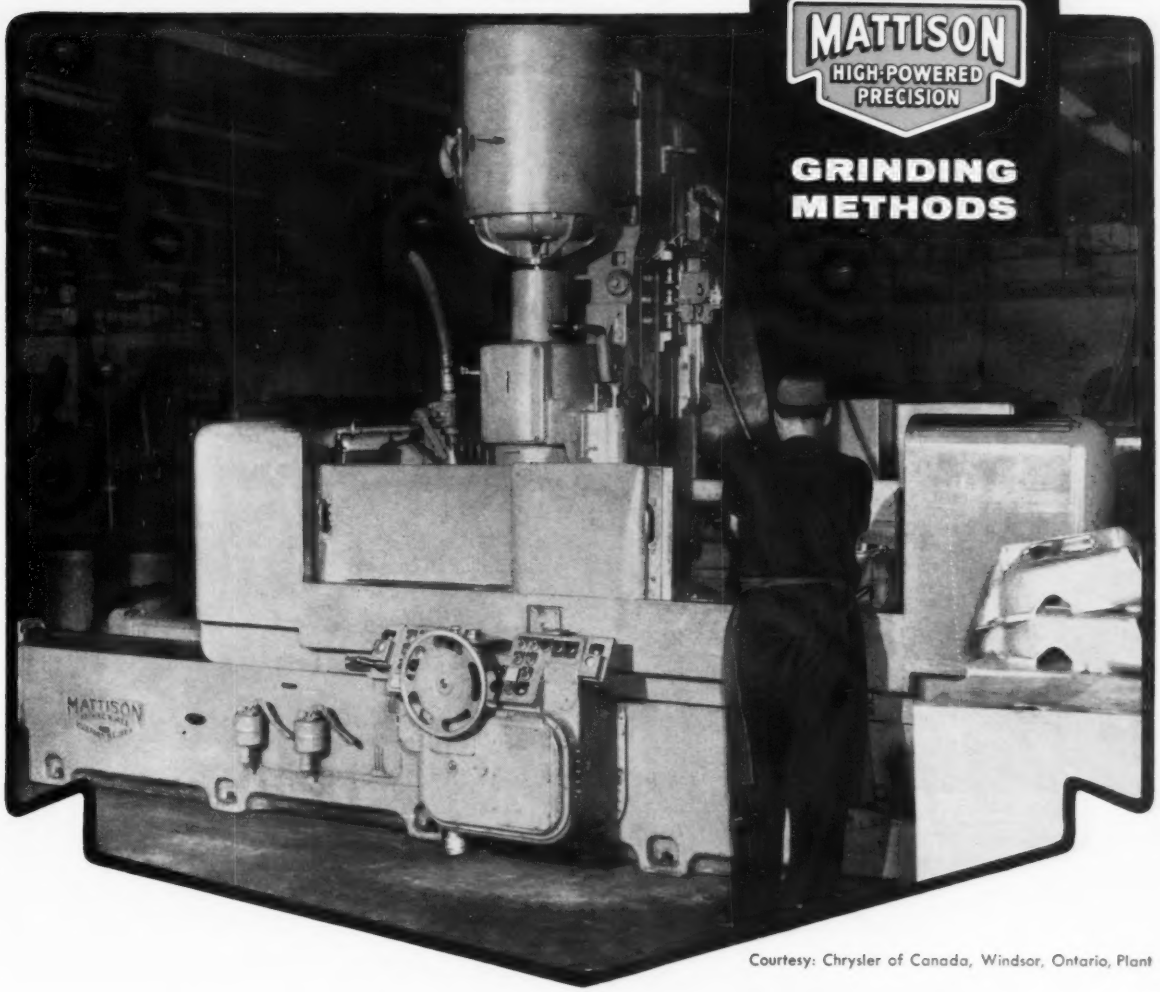


MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 40—TORQUE CONVERTER HOUSINGS

MATTISON
HIGH-POWERED PRECISION

GRINDING METHODS



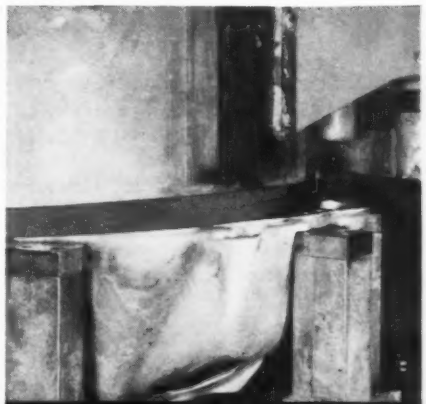
Courtesy: Chrysler of Canada, Windsor, Ontario, Plant

Mattison grinders selected to produce high-quality automotive parts!

Chrysler of Canada wanted only the best methods to produce high-quality V-8 engines in their new Windsor, Ontario, motor plant. The Mattison Duplex Rotary Surface Grinder, shown here performing a delicate finish grinding operation on aluminum housings, is typical of the machines selected.

The duplex table design permits the operator to set up one work table while the second table is under the wheel . . . eliminating nonproductive machine time. Up to 40 parts per minute are finish-ground on two faces, using this system . . . despite the special handling required to keep the aluminum walls from "springing." A special fixture was developed jointly by Mattison and Chrysler engineers to solve this problem.

The massive construction . . . high-powered spindle drive . . . and free-cutting action of the Mattison Duplex Rotary insure maximum stock removal and accuracy . . . that's why more and more metalworkers are coming to Mattison for high-powered precision grinding equipment. Ask for Bulletin 145-4RM for complete information.



Parallelism and flatness are held to .003 in. on both engine and transmission faces of these aluminum torque converter housings.

MATTISON
MACHINE WORKS
ROCKFORD ILL. U.S.A.

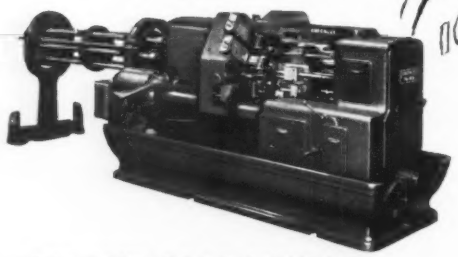
HIGH-POWERED
PRECISION
SURFACE
GRINDERS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

Dependable...

PRODUCTION MACHINERY

GREENLEE Automatic Bar Machines



SIX AND FOUR-SPINDLE AUTOMATIC BAR MACHINES

GREENLEE Special Machine Tools

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Hydro-Borer Precision Boring Machines

BOOST PRODUCTION REDUCE DOWN TIME

It's easy to maintain rigid production schedules . . . prevent costly bottlenecks with Greenlee Bar Automatics. They are always on the job . . . give continuous, reliable service.

You hear much comment about Greenlees' uninterrupted, round-the-clock performance in widely different industries. With good reason, too, for Greenlee offers years of manufacturing experience... plus manufacturing integrity not often duplicated.

Want complete information? Call in the Greenlee man. Let him give you the complete story. Please submit a print when inquiring about a specific job.

WRITE FOR CATALOG No. A-405

GREENLEE BROS. & CO.

1865 MASON AVENUE
ROCKFORD, ILLINOIS

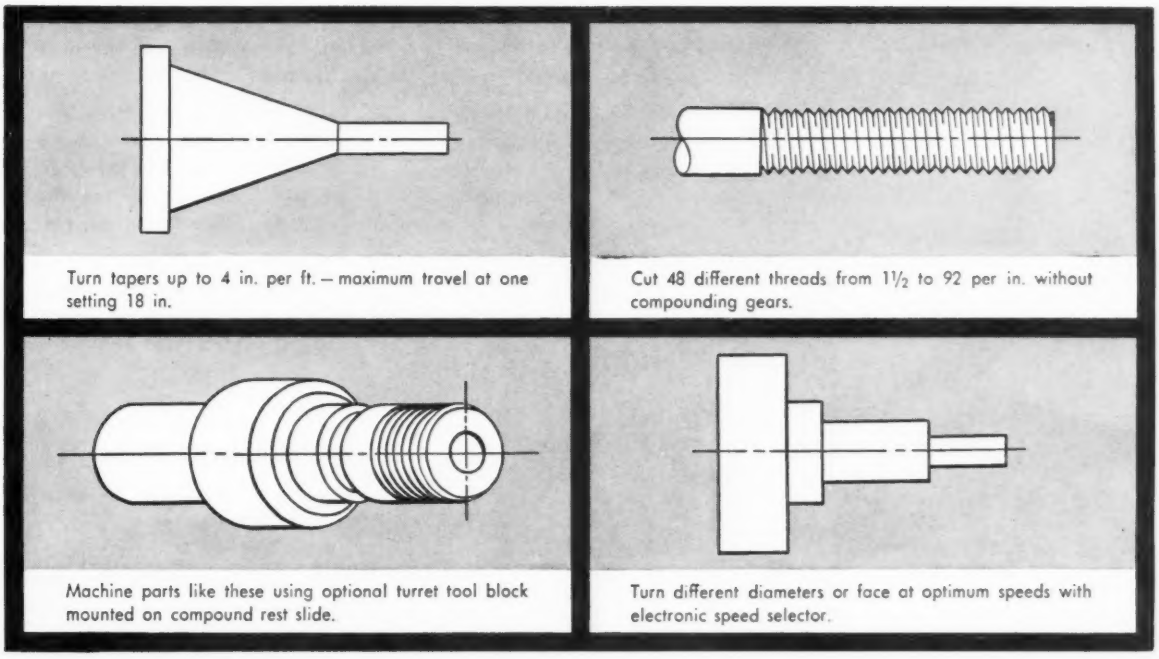
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

You get

top value per dollar

with a Hendey No. 2E Lathe

do all these different jobs better, at exactly the right cutting speeds!



Turn tapers up to 4 in. per ft. — maximum travel at one setting 18 in.

Cut 48 different threads from 1½ to 92 per in. without compounding gears.

Machine parts like these using optional turret tool block mounted on compound rest slide.

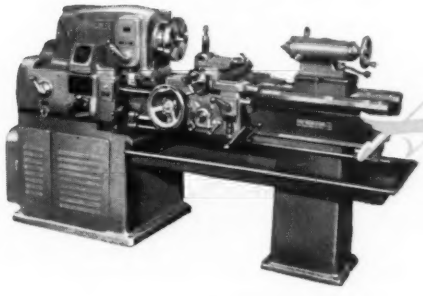
Turn different diameters or face at optimum speeds with electronic speed selector.

Tapers, threads, multiple diameters, and multiple tool-turning — they're all the same on the Hendey No. 2E.

Whatever the job, you know Hendey's infinitely adjustable electronic drive puts the right turning speed at the operator's fingertips. Every control for the cutting tool and spindle is fast, easy, and precise!

Contour turning, too, is available where required. The Hendey No. 2E 14" general-purpose lathe can be equipped *in minutes* with an optional tracer attachment. Learn how quickly this multi-feature lathe will pay for itself in your shop or toolroom. Contact your Hendey dealer for details and complete machine specifications.

for precision with production, buy Hendey



Hendey **machine division**

BARBER-COLMAN COMPANY

52 Loomis St., Rockford, Illinois

BARBER COLMAN ®

FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.

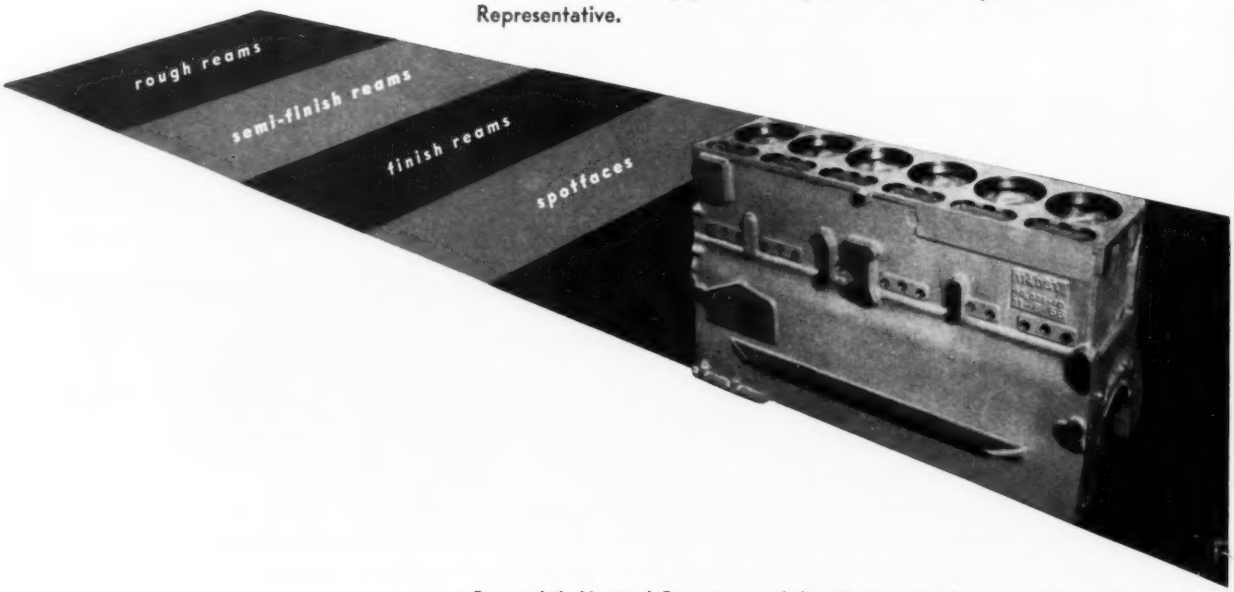
BARNESDRIL
combines 72 operations

This BarnesdriL Vertical Reaming and Spotfacing Machine rough reams, semi-finish reams, finish reams and spotfaces diesel engine blocks. It combines a total of 72 machining operations into a single machining cycle with six positions.

At the first position, 12 valve guide bores are rough reamed and 18 pads are spotfaced. The second position rough reams 6 injector bores. Third and fourth positions semi-finish ream the 12 valve guide bores and the 6 injection bores. At the final two positions both the valve guide and injector bores are finished reamed.

Previously, the machining of these blocks was performed by a Slip-Spindle-Type Machine with a two position fixture. The 12 valve bores were machined in one position and the 6 injector bores in the other. Alternate passes were made for rough, semi-finish and finish reaming with tool changes being made after each pass. Spotfacing was performed on another machine.

Combining operations into a single machine to cut labor costs and to meet required production rates, is the business of BarnesdriL. If you have a hole finishing production problem, contact your BarnesdriL Representative.



BarnesdriL Vertical Reaming and Spotfacing Machine consisting of: A Saddle Type Unit arranged for rapid approach, feed and rapid return on vertical column with a 54-spindle reaming head; a Saddle Type Unit arranged for rapid approach, feed and rapid return on a horizontal base section with an 18-spindle auxiliary head; a 6-position 10" index automatic hydraulic lateral index table; an automatic lubricating system and fixture.

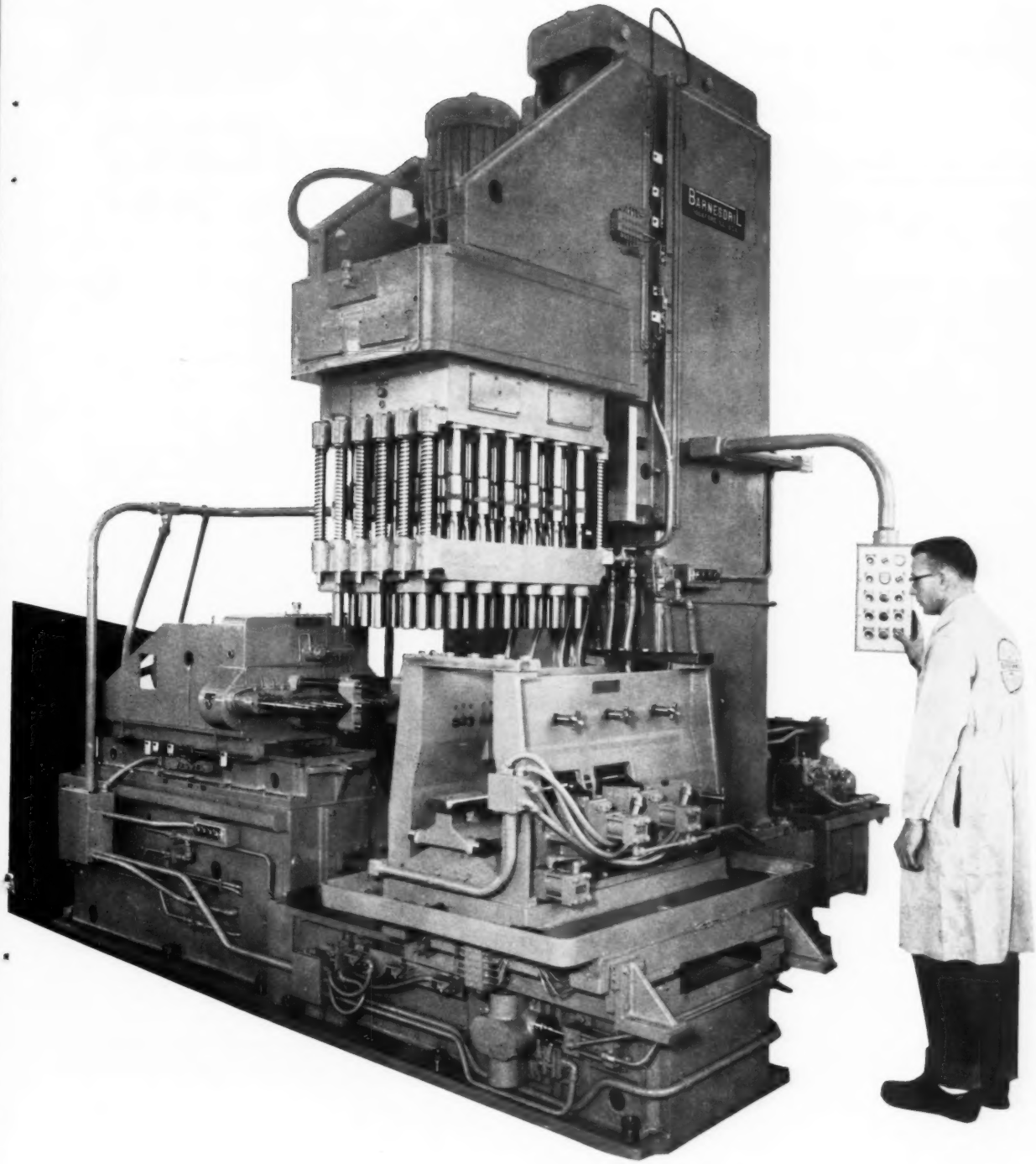
50th year

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 3419 South Telegraph Road

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

into a single machining cycle



Machinery, May, 1957

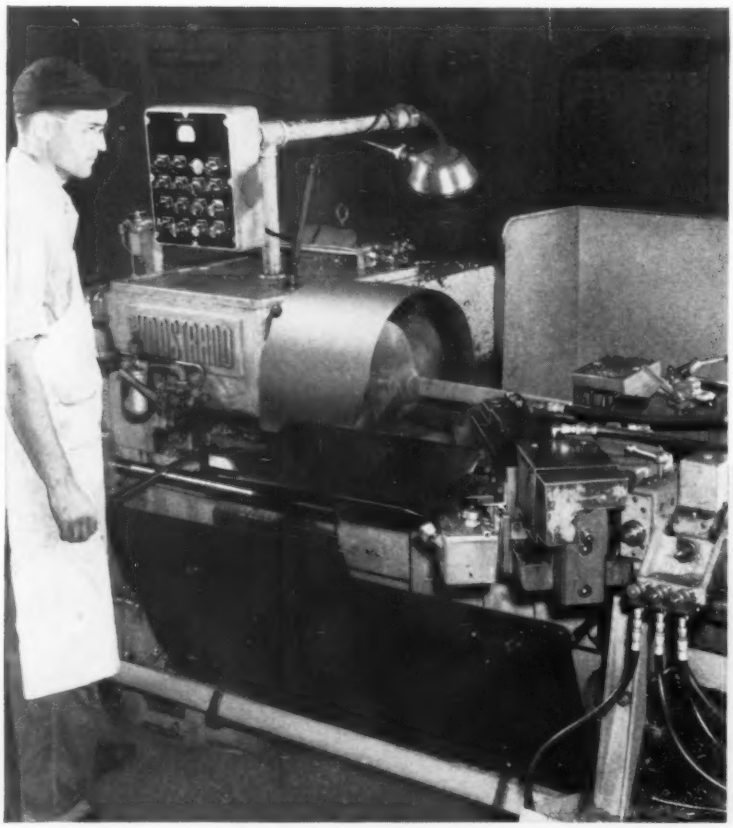
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

Before buying any Tracer Turning Equipment

See what you get with **SUNDSTRAND**

"Engineered Production"

FOR EXAMPLE: Production increased 80% on miscellaneous turning jobs!



Here's an example of how one company uses a Sundstrand Tracer Lathe to improve production over previous turning methods. Lot sizes are small, set-up time is short, and production has increased approximately 80%.

Large or small-lot tracer turning—including the jobs that call for heavy cuts—are being handled with unprecedented efficiency on Sundstrand automatic lathes. Substantial savings and a high degree of flexibility in operations are being realized regularly in metalworking plants of every size using the tracer setups best suited to their operations. Ruff, semi-finish, and

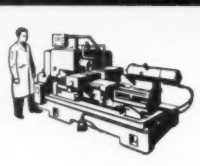
Parts shown above are ruff, semi-finished and finish turned in one automatic multi-cut cycle and with only one template for each part.

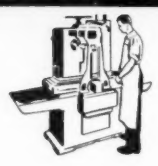
SUNDSTRAND

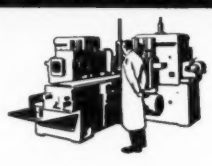
*"Engineered Production" Service**

*REG. U.S. PAT. OFF.

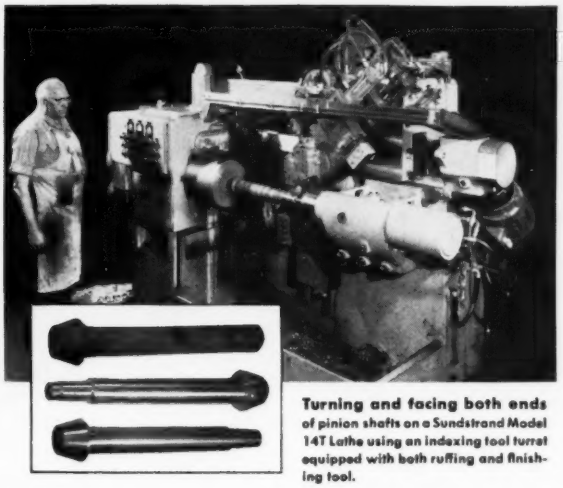
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS



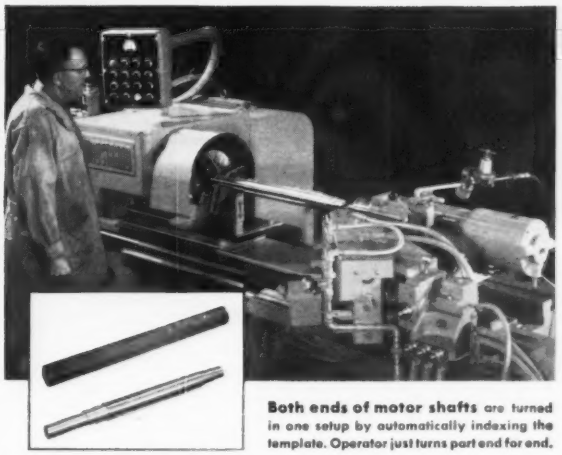




MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



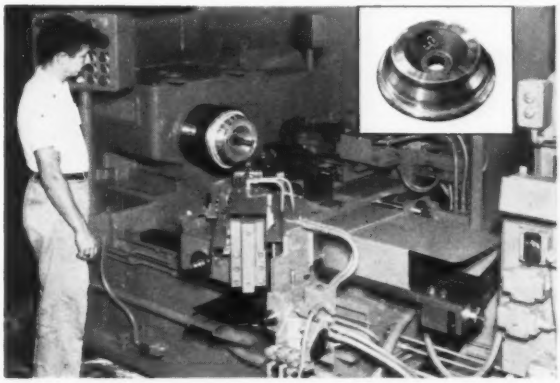
Turning and facing both ends of pinion shafts on a Sundstrand Model 14T Lathe using an indexing tool turret equipped with both ruffing and finishing tool.



Both ends of motor shafts are turned in one setup by automatically indexing the template. Operator just turns part end for end.

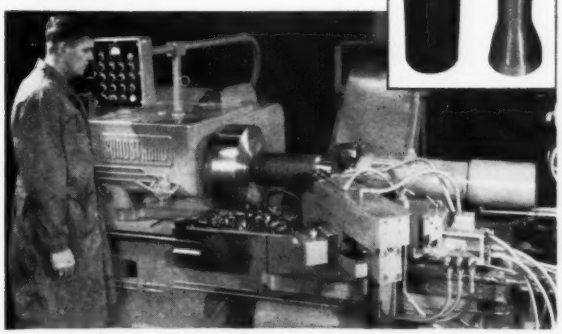
finish cuts can be made in a single automatic cycle using just one template. Lathes can also be provided with ruff and finishing tools in quick indexing turrets or with automatic template indexing where both ends of a part are handled in one machine.

Sundstrand's "Engineered Production" Service assures the selection of the tracer lathe best suited to obtain the most practical turning method for your machining requirements. A complete range of standard, as well as special Multi-Cycle Tracer Lathes are available to fulfill your requirements.



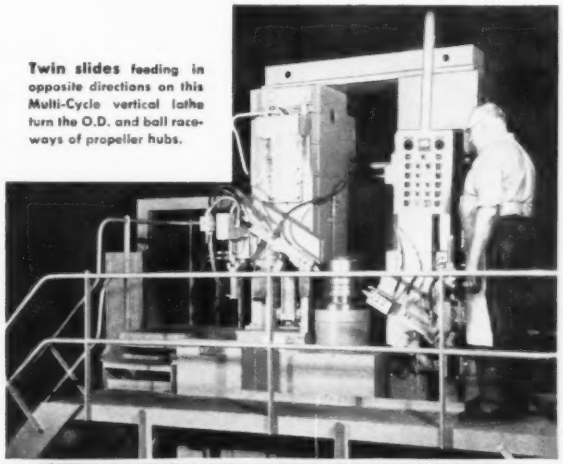
Turning, boring, and knurling the irregular contour of magnesium aircraft wheels.

Additional information on Sundstrand Multi-Cycle Tracer Control is available in Bulletin 679. Write for your free copy today.

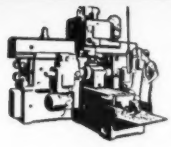


A four cut automatic cycle speeds the heavy stock removal on rock drill parts. Easily adjusted stops control the automatic cycle of this tracer lathe. A hydraulically actuated rear slide grooves the shank end of the part.

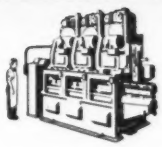
Twin slides feeding in opposite directions on this Multi-Cycle vertical lathe turn the O.D. and ball raceways of propeller hubs.



TRIPLEX RIGIDMILS



SPECIAL MACHINES



SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

the New Rockford Tracer Lathe . . .

with hydraulic KOPY

Machinery, May, 1957

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

- KAT DUPLICATOR

. . . is the greatest value ever offered in a tracer lathe. Forty years of building fine lathes and 25 years of hydraulic duplicating experience make an unequalled combination. Extreme accuracy of duplication, coupled with enough ruggedness to utilize the full horsepower of the machine, make Rockford Tracer Lathes the preference for repetitive turning in any volume.

The Rockford Tracer Lathe can be converted to a completely standard engine lathe in a matter of minutes, thus adding to its versatility and flexibility for small lot production.

Complete interchangeability of multiple diameter work can be achieved by unskilled operators at production speeds comparable to turret lathes. These machines are rugged enough for heavy production work, yet flexible enough for tool room or job shop production.

Ask for bulletin No. 1002, or send us prints of your applications for free production estimate.

check these

PLUS FEATURES

Duplicating attachment designed and built by the lathe manufacturer specifically for Rockford Lathes. No divided responsibility.

Kopy-Kat Valve features proven accuracy, precision manufacture, built-in retract.

Power unit requires no additional floor space - includes sealed unit, compensating pump and filter.

Electrical controls are combined and interlocked with machine controls from centrally located push button station.

European tool post.

All hydraulic lines are clear of chips and coolant - out of the operator's way.

Automatic feed cut-out - a standard feature on Rockford Tracer lathes.

MEDIUM-SIZED
ECONOMY-PRICED

ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

"Engineered Production" Service

FOR BROACHING

It takes all 3

American's *"Engineered Production"* Service

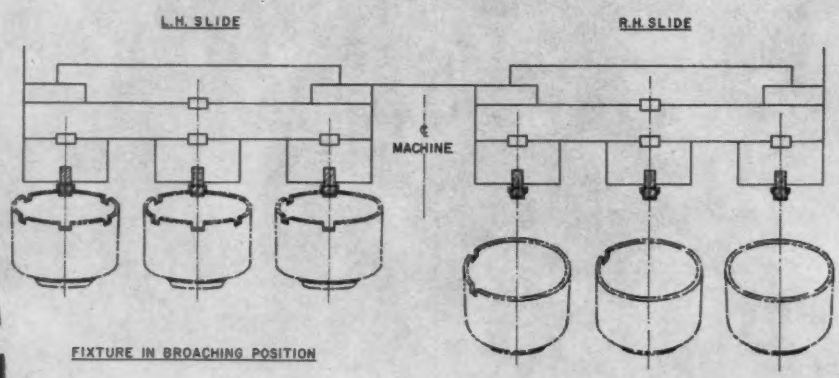
. . . gives the broach-user the complete three-part service that is essential to obtain the most practical broaching method. Years of design and production engineering experience, unavailable at any price, are effectively added to your staff at no extra cost.

THE JOB — Broaching six .602 – .606 inch wide, .38 inch deep slots in the face of a 5.5 inch diameter hub. The bottom face of the slot is finished at an angle.

THE RESULT — 150 completed pieces per hour. Two automatically indexing, three-station fixtures hold the six parts. The operator has only to load and unload parts and start machine cycle.

1 PROPER BROACH TOOL DESIGN

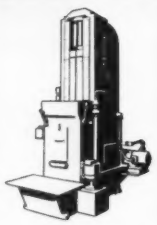
Top-quality results on any broaching operation require starting the job with design of the broaching tool itself. In solving this all-important first step, American Broach considers stock removal, length and width of cut, finish, tolerances required, etc. American's experience in designing and building broaches for every type of part capable of being broached pays off in quality of work and in long tool life. You can be sure the broach and machine will operate as a team because they are designed that way.



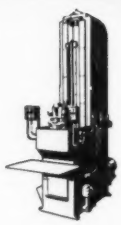
FIXTURE IN BROACHING POSITION

FIXTURE IN LOADING POSITION

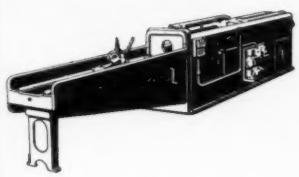
Broaching Tools



Three Way



Single Ram



Horizontal

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

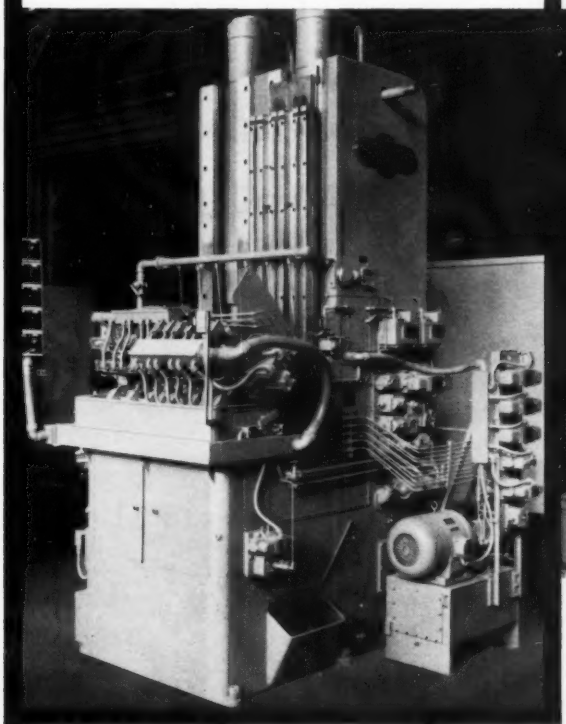
to give you peak broaching performance

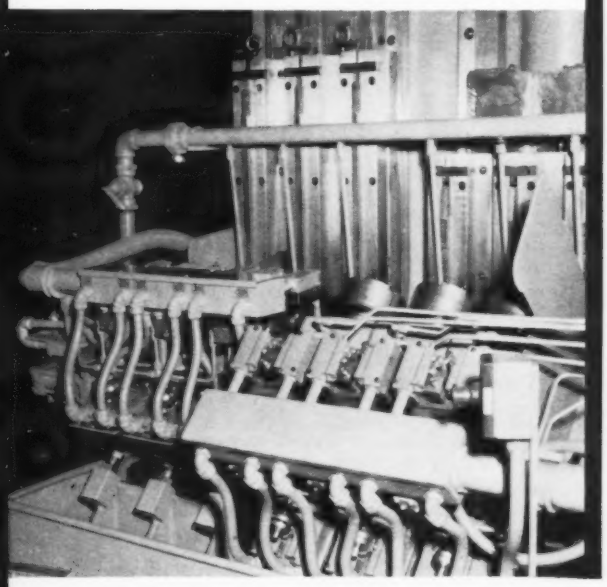
2 SPECIFYING THE RIGHT MACHINE

Production rate required, length and speed of stroke, relationship to other production machinery, and available floor space determine the selection of the broaching machine capable of doing the best job. At American, machine selection follows design of the broaching tool. Because American builds a complete line of standard machines and has extensive experience with specials, you can depend on getting the most practical machine for your job.

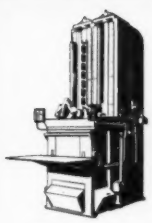
3 EFFICIENT FIXTURING

Whatever your part geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. Whether manual loading and unloading is used or the work cycle is completely automatic, work-holding fixtures designed and built by American Broach feature easy loading and unloading coupled with positive clamping during the broaching cycle. Even with relatively inexperienced operators, production schedules are maintained since the "skills" are built into the tool, machine, and fixtures.





For more information on practical broaching methods write for Bulletin A614.



Duplex Ram

Presses

SUNDSTRAND

American

BROACH & MACHINE DIVISION

SUNDSTRAND MACHINE TOOL COMPANY

ROCKFORD, ILLINOIS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

5 DIFFERENT WORKPIECES PROCESSED ON ONE W. F. & JOHN BARNES SPECIAL MACHINE

Versatile Tooling and Special Machine Precision Lower Costs, Improve Quality of Motor Grader Transmissions

This W. F. & John Barnes unit, designed and built for the J. D. Adams Manufacturing Co., Indianapolis, Ind., combines all the built-in advantages of a special machine . . . yet it machines not one, but FIVE separate and dissimilar workpieces that together form a complete transmission housing. Ingenious planning of spindle arrangement, tooling, and fixtures enables only 31 spindles to perform a total of 53 operations on the five workpieces. Special fixtures and numbered gauges locate the work and tooling quickly and accurately . . . complete change-over from one housing section to another averages only six hours.

Engineering and building a distinctive machine like this just doesn't happen by accident . . . it's the result of over 75 years of accumulated knowledge in a highly specialized field. That's why at Barnes you'll find the creative skills, plus complete and adequate facilities, for designing and building better machines to lower your production costs . . . improve product quality.

ASK FOR AN ANALYSIS OF YOUR PRODUCTION METHODS

Find out how Barnes' unique creative and specialized resources can help you cut costs. Your problem will be given expert and individual attention.

W. F. & JOHN BARNES

BUILDERS OF BETTER MACHINES SINCE 1879

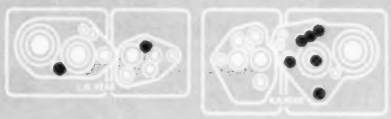
MULTIPLE SPINDLE DRILLING • BORING • TAPPING

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

EKSTROM,

LOWER TRANSMISSION CASE

2 Operations **6 Operations**



INTERMEDIATE PLATE

5 Operations **10 Operations**

UPPER TRANSMISSION CASE

8 Operations **10 Operations**

UPPER TRANSMISSION CASE COVER

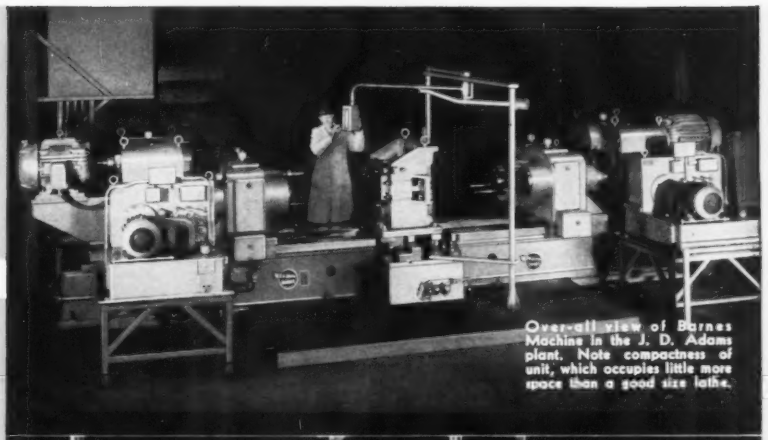
Idle **6 Operations**

FINAL DRIVE HOUSING

2 Operations **2 Operations**

AUXILIARY HEADS COMPLETE 2 OPERATIONS AT RIGHT ANGLE TO REGULAR MACHINE SPINDLES

Drawings illustrate the spindle arrangement in the opposed heads and how they are individually tooled to perform chamfering, rough, semi-finish and finish boring, and facing operations in the five different workpieces. Two auxiliary heads mounted at right angles to the machine bore dowel holes in the Final Drive Housing.



Over-all view of Barnes Machine in the J. D. Adams plant. Note compactness of unit, which occupies little more space than a good size lathe.

Closeup of fixture used for Upper Transmission Case. Note rings for quick removal. Spindle housings are divided and gear boxes separated from housings to minimize heat rise.

INVESTIGATE BARNES' 6-POINT MACHINE TOOL BUILDING SERVICE . . .

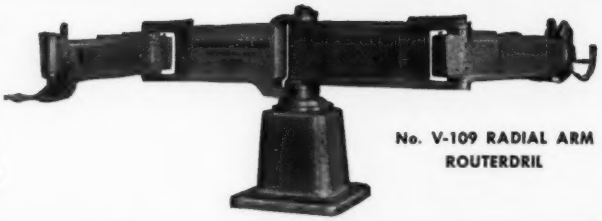
A Coordinated Creative Engineering and Manufacturing Service designed to help you solve problems quickly and efficiently. Write today for your free copy of "*Coordinated Machine Engineering*".

W. F. & JOHN BARNES COMPANY • 402 SOUTH WATER ST., ROCKFORD, ILLINOIS

MACHINES • AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

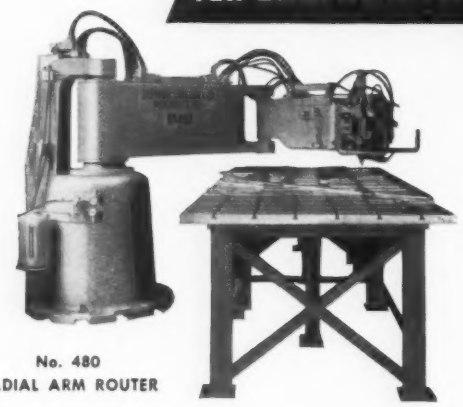
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

EKSTROM, CARLSON MACHINES



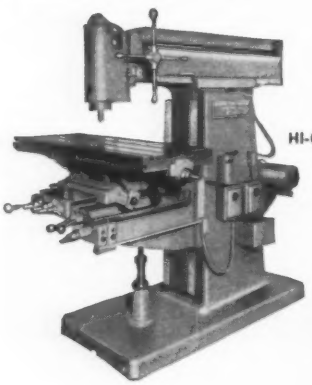
No. V-109 RADIAL ARM ROUTERDRIL

FOR GREATER AIRCRAFT PRODUCTION!

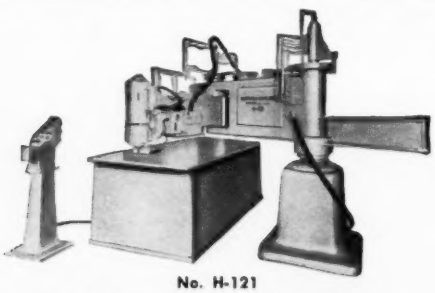


No. 480
RADIAL ARM ROUTER

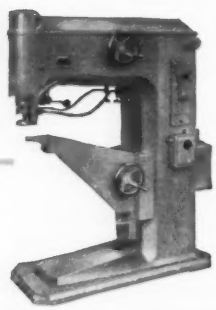
New concepts—new designs—new mechanisms—new highs in production capacities—new standards of performance . . . these outstanding attributes are typical of Ekstrom, Carlson & Co. products for the aircraft industry! Look over the items shown here—pick out those that may fit your present and future plans—then write for free literature giving full and interesting information.



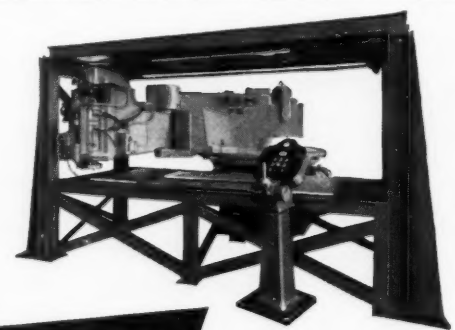
No. 540-HC
HI-CYCLE UNIVERSAL ROUTERMIL



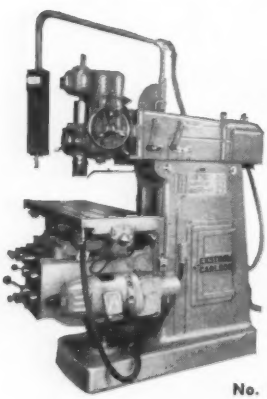
No. H-121
HYDRAULIC-ELECTRIC CONTOUR ROUTER



No. 434-H HORN ROUTER



No. 400
CAV-RO-MIL



No. 5-VA VERTIMIL

by EKSTROM, CARLSON

EKSTROM, CARLSON & CO.
Dept. M-4, 1400 Railroad Ave., Rockford, Illinois

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

HAYNES Alloys solve *tough* wear and corrosion problems

New Method

Eliminates maintenance on bearing area of shafts

After 17 months of grueling service in the sandy salt water of New York's harbor and surrounding waters, a tail shaft sleeved with a HAYNES wrought alloy at the outer bearing area showed only 0.015 in. wear. A bronze sleeve used in this same service wore over ¼ in. in 15 months.

This remarkable improvement in wear resistance was accomplished quickly and economically by the use of half sleeves made of HAYNES STELLITE alloy. Three sets of the half sleeves protected the bearing area of the shaft.

For more information on the many industrial applications for HAYNES STELLITE alloy half sleeves and bushings, ask for a copy of our free booklet.

No Wear or Corrosion After 17 Months. Tug's tail shaft is removed for inspection of HAYNES STELLITE alloy sleeves at the outboard bearing area. The sleeved surface still has a mirror-like finish.

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

Sales Offices

Chicago • Cleveland • Detroit • Houston • Los Angeles
New York • San Francisco

HAYNES TRADE-MARK ALLOYS

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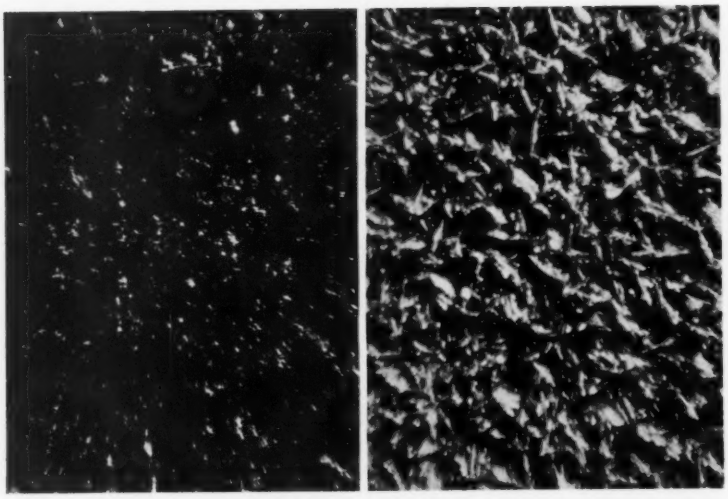
CrysCoat* first, then paint...

to greatly prolong finish life

Left: Cold rolled steel greatly magnified. This surface is unprotected against electrochemically-caused corrosion, and adds nothing to the adhesion of paint.

Right: Identical panel, after Oakite zinc phosphating. Now it has *integral* protection against rust, and a better paint-gripping surface.



Metal surfaces become a better base for organic finishes when put through the Oakite CrysCoat Process. They're cleaned and phosphate-coated at the same time. The inert coating formed is integral with the surface. It not only provides plenty of "tooth" to grip paint finishes tenaciously, but also blocks rusting and prevents "creeping corrosion" under the paint film.

Famous-name products of all kinds are today being CrysCoated first for a finish that looks better, lasts longer.

There's an Oakite CrysCoat Process to suit *your* specific set-up and production needs, too. CrysCoating for zinc or iron phosphate coatings can be done by spray-washer or by tank...and with easy control, economy of solution make-up and other operating advantages. Send for Bulletin F.8979R and F.9475 which describe CrysCoat Processes ...or better still, let the CrysCoat Man give you all the details.

Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

**A complete phosphating process by Oakite.*

SPECIALIZED INDUSTRIAL CLEANING

OAKITE®

MATERIALS · METHODS · SERVICE

SCIENCE

Export Division Cable Address: Oakite

Technical Service Representatives in Principal Cities of U. S. and Canada

for dependable deliveries of cold rolled specialty steels —call CRUCIBLE

Crucible is geared to give you *reliable, on-time deliveries* of a wide variety of cold rolled specialty steels—carbon spring, alloy strip . . . coils or cut lengths . . . in the size, finish and temper you specify.

And you're sure of *quality* from Crucible—*fine finish . . . better edges . . . improved flatness.*

So, for prompt deliveries, timed to meet your production schedules—call Crucible. And, for handy reference—mail the coupon for your free copy of Crucible's 32-page fact-filled book on cold rolled specialty steels. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

Crucible Steel Company of America
The Oliver Building, Mellon Square, Pittsburgh 22, Pa.

I'd like a copy of your 32-page booklet on cold rolled specialty steels.

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

CRUCIBLE first name in special purpose steels

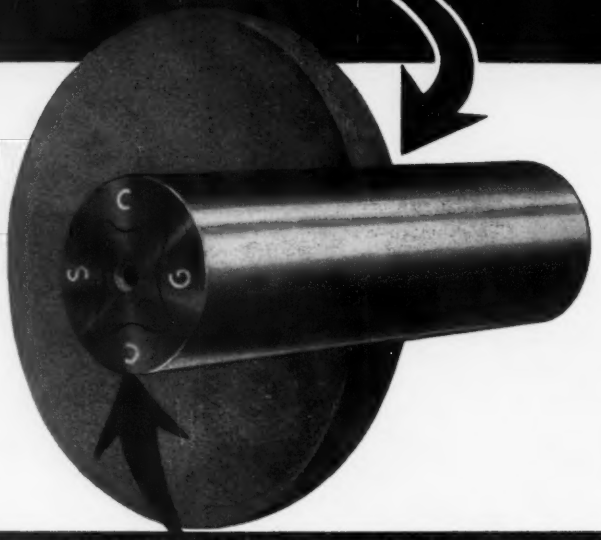
Crucible Steel Company of America

An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight,
smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

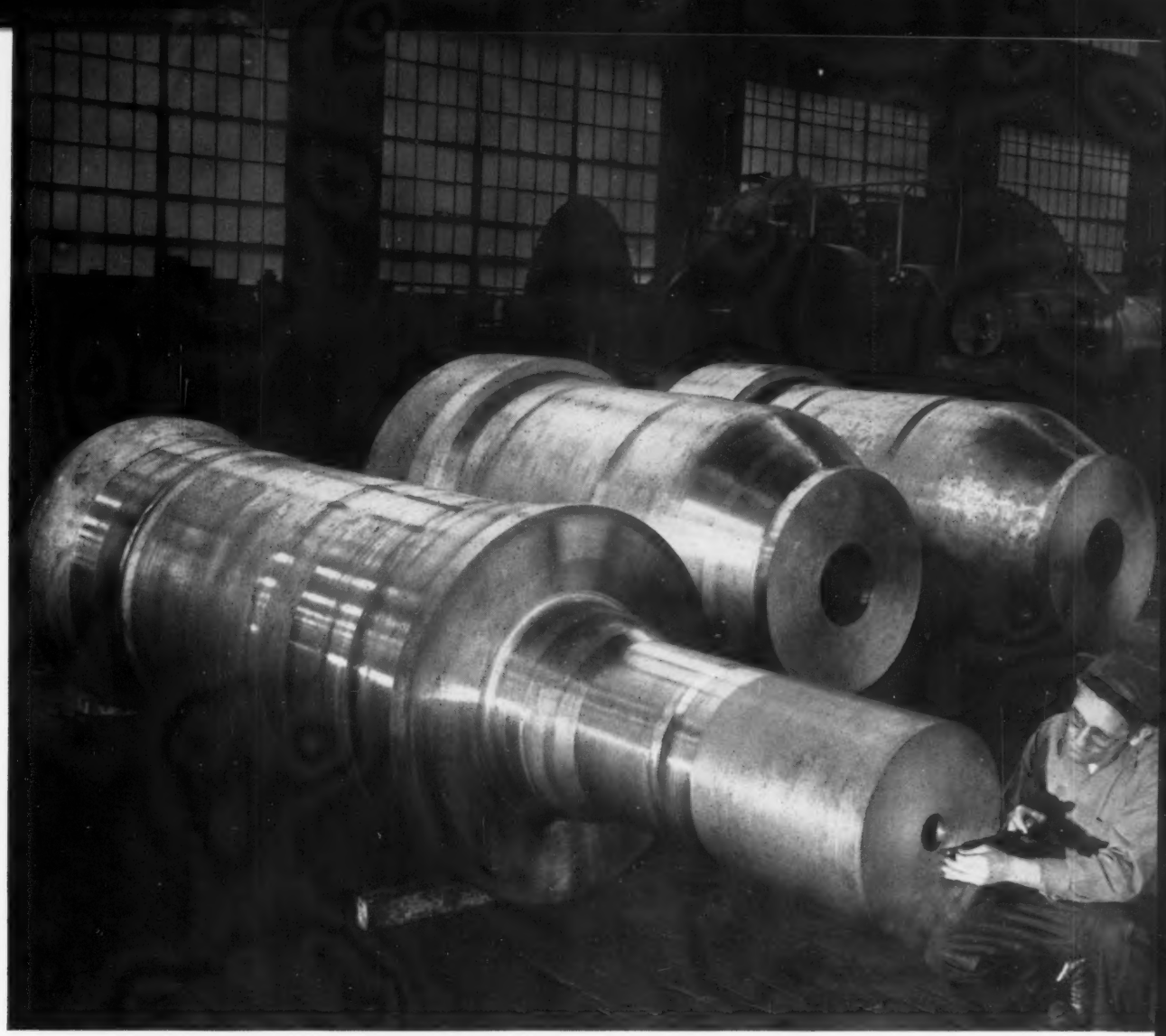
Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 **INCORPORATED 1892**

For more information fill in page number on Inquiry Card, on page 241



BIG FORGINGS
to help make other forgings

These three forgings have a strong family tie, since they were all made in the Bethlehem shops for use in the same machine. That machine, by the way, is a mechanical monster whose job is to make more forgings. It exerts tremendous pressures, so the components you see in the picture have their work cut out for them.

In the foreground, looking very much like a giant potato-masher, is a pullback cylinder; length, 13 ft 8 in. The OD of the main body ranges from 43 to 46 in. Weight of piece as shown, 26,550 lb.

The twin forgings in the background are intensifier cylinders. Each has a maximum OD of 58 in. and an overall length of 7 ft 11 in. Each weighs 27,640 lb. Thus, though the camera may have fooled you, these pieces are actually somewhat heavier than the pullback cylinder.

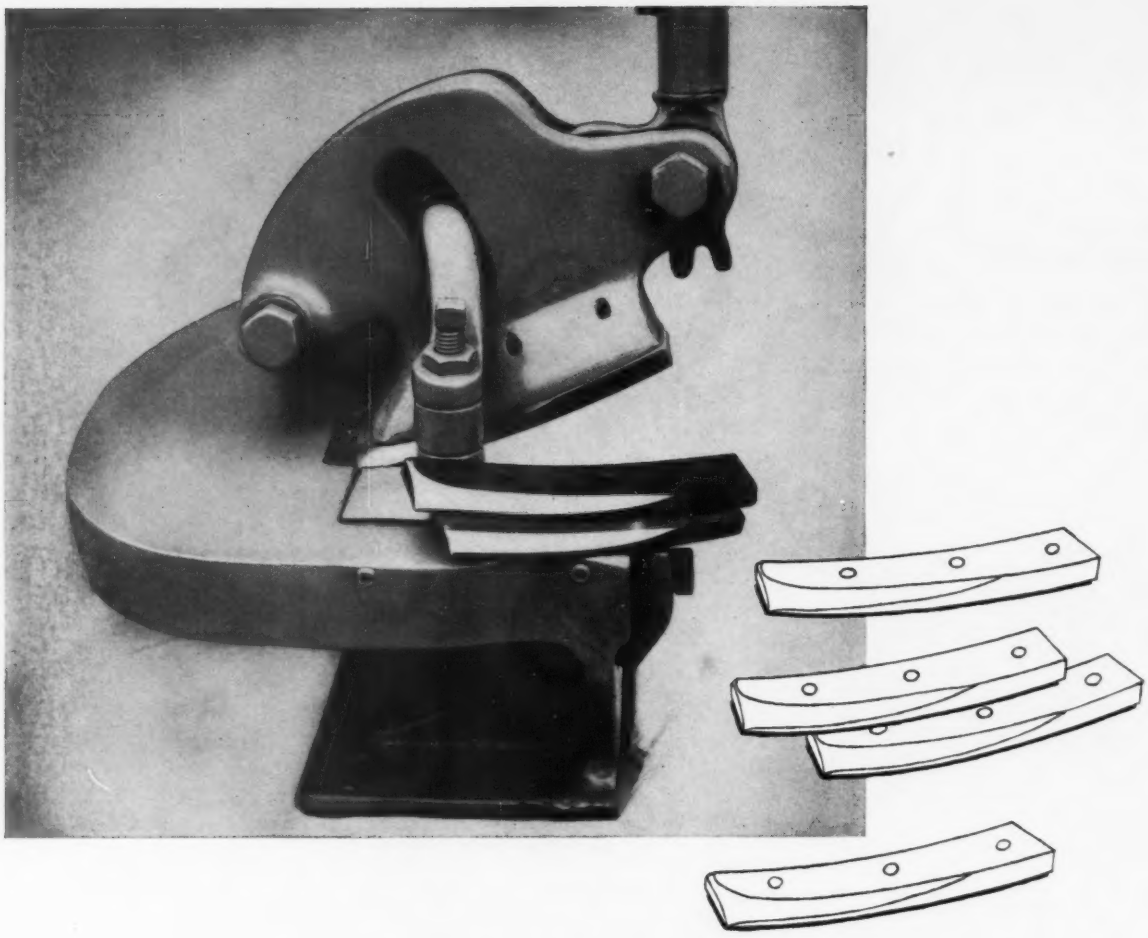
You may never require any forgings of quite the same nature. Perhaps your needs run to much smaller items, or to something much larger. In any case, Bethlehem is fully prepared to take care of you. Our shops can meet your specifications on all types of drop, press, and hammer forgings, regardless of size or design. Inquiries always welcomed.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



Shear Manufacturer ups blade life 4 to 5 times...

with A-L HURON DIE STEEL

Write for Your
HURON BLUE SHEET

A compilation of facts on the handling and shop treatment of Huron. Includes complete information on forging, annealing, tempering, etc. and detailed laboratory data on physical characteristics. *Ask for your free copy.*

ADDRESS DEPT. M-88

A Chicago bench shear manufacturer produced some test blades of A-L HURON die steel—heat treated to 61-62 Rockwell C.

Service life of the HURON blades proved to be four to five times that of the former blades. Resharpenings were reduced 75 to 80%! Because these new HURON blades held an exact rake and maintained a proper cutting arc, they easily sheared 3/16" mild steel or 10 gauge stainless.

HURON die steel was developed for use where high resistance to wear and abrasion is necessary, and where heavy pressure rather than sudden shock must be withstood. HURON has excellent non-deforming properties, and hardens to a great depth.

There is an A-L tool steel that will help solve your cutting, forming or blanking problem. Call our nearest office or distributor today about your requirements. ***Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.***

For nearest representative, consult Yellow Section of your telephone book.

For complete **MODERN** Tooling, call

Allegheny Ludlum

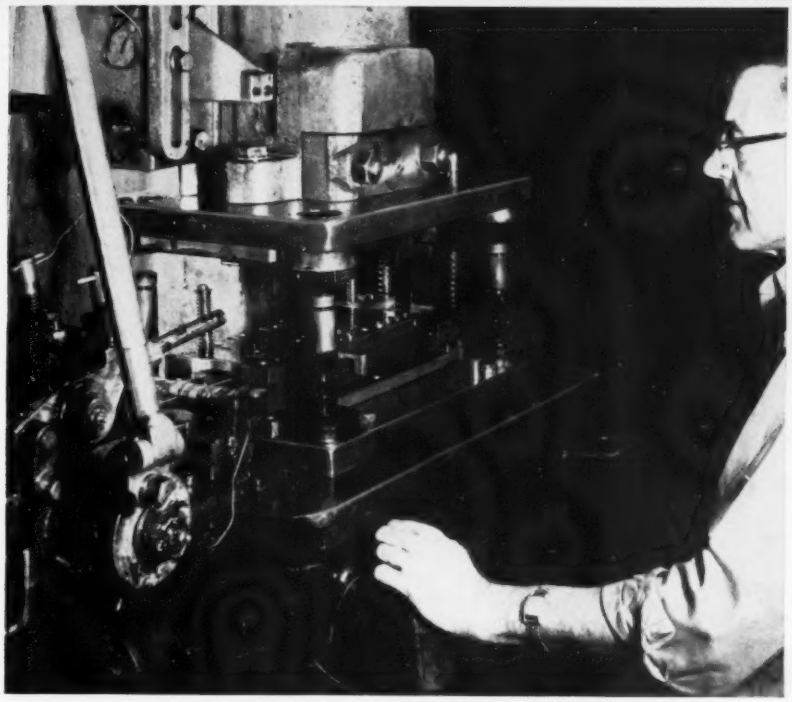
WSW 6366

AL® FINE TOOL STEELS SINCE 1854

For more information fill in page number on Inquiry Card, on page 241

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



Lehigh H does good job in blanking-and-forming die

Wear-resistance, low distortion, and high compressive strength were the tool-steel requirements needed for a blanking and forming operation at Hickory Springs Manufacturing Co., Hickory, N. C., makers of bed rails and platform rocker hinges. Their choice, and it was a good one, too, was Bethlehem Lehigh H.

The jobs involved blanking and forming cold-rolled strip in thicknesses from 0.060 in. to 0.078 in., in presses of up to 80 tons capacity. The Lehigh H dies, hardened to Rockwell C 58-61, performed satisfactorily, producing about 100,000 pieces between grinds. Only 0.015 in. was removed in redressing.

Bethlehem Lehigh H is an outstanding high-carbon, high-chromium grade of air-hardening tool steel, with the characteristics to take the tough jobs in stride.

TYPICAL ANALYSIS

Carbon 1.55	Molybdenum 0.80
Chromium 11.50	Vanadium 0.40

You'll like Lehigh H the very first day you put it to work. But don't baby it! Give it a real test, one that requires a combination of wear-resistance, shock-resistance, and compressive strength. Your Bethlehem tool-steel distributor has Lehigh H tool steel in stock. Why not call him right now, while you have it in mind.

You Save Time with Hollow-Bar →

If you work with hardened bushings, ring dies or draw rings—in fact, any part requiring a center hole in the steel—you'll save time by using Bethlehem Hollow-Bar Tool Steel. Bethlehem Hollow-Bar is made by a high-speed trepanning process, by which hammer-forged or hot-rolled bars are cored out, then rough-turned on the outside. Hollow-Bar arrives ready to go to work. There's no time lost, no waiting for forged rings or dises. Hollow-Bar is furnished in BTR (Bethlehem Tool Room, oil-hardening), and Lehigh H (high-carbon, high-chrome).

BETHLEHEM TOOL STEEL ENGINEER SAYS:

You Can Salvage Tools Which Have Grinding Cracks

When produced, grinding cracks are usually shallow (0.002 in. to 0.004 in.). If their presence is detected early, it is often possible to salvage the tool, assuming that metal-removal will not render the tool unusable. This can be done by cautious grinding, which removes but a small amount of metal (0.00025 in. per pass), and does not generate excessive heat. To keep heat at the minimum, use a soft, coarse-grit, 36-grain wheel, plus a liberal amount of liquid coolant.

If a number of light cuts are taken, with intervals between cuts to prevent building up temperature, the grinding cracks can be removed, so long as the tool has been properly heat-treated. But if ordinary grinding technique is used, the cracks will enlarge ahead of the grinding wheel, and ultimately will go all the way through the section.

Magnetic-powder testing is required for examination of the tool during the salvage operation, in order to determine when the cracks have been removed. If grinding cracks are detected before a tool is used (this requires magnetic-powder testing in most instances), salvage is usually successful. But should a tool be put in service with undetected grinding cracks, salvage may be impossible because of growth of the cracks in service.

star performer

...and among high speed steels

REX is the leader

Crucible REX® high speed steel has been the winner in shop tests for more than fifty years. *And now REX is even better than ever!* For Crucible research and experience has led to improved manufacturing techniques that mean higher quality – greater uniformity.

Prove the superiority of REX for yourself – on your next job. Check it for size, structure, response to heat treatment, all-around tool performance. Then you'll know why REX has always been the *standard by which other high speed steels are compared.*

REX is immediately available at all of Crucible's convenient warehouses – or through prompt mill delivery. For a list of available data on REX and other Crucible *special steels*, write for a free copy of the "Crucible Publication Catalog". *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

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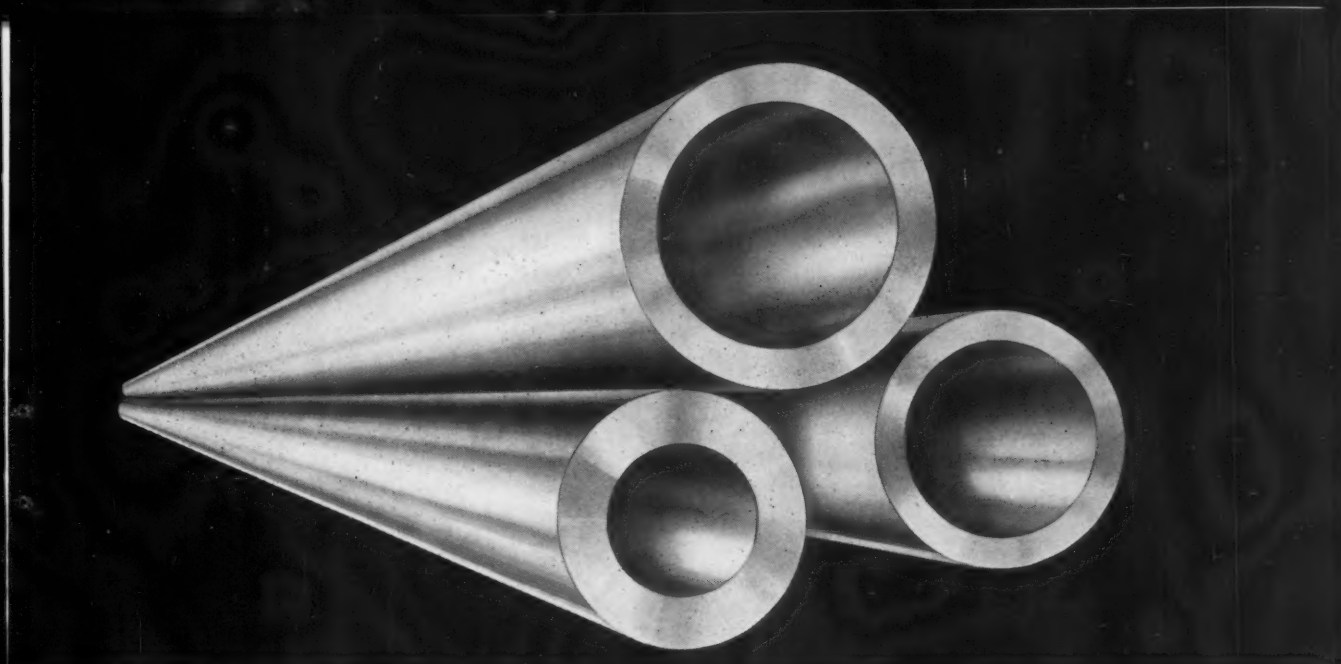
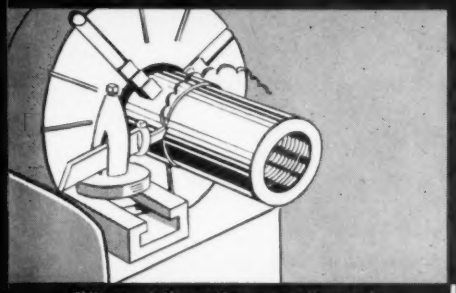
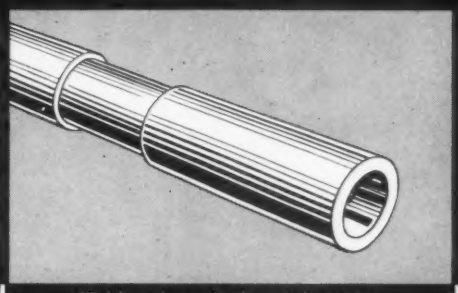
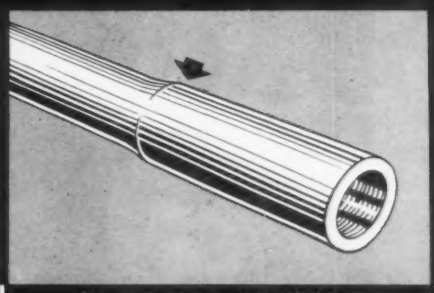




Worn drill collars are "peeled down" for perfect roundness, eliminating surface scars and imperfections.



Tubing sleeve is shrunk into perfect position.



Sleeves are securely welded. Thus drill collars go back into service actually as good as new.

MATCHING TUBES TO JOBS

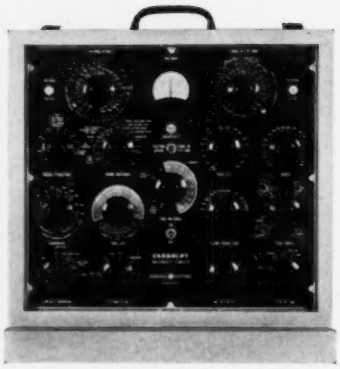
Drill collars and tool joints can't last forever in oil well equipment service. Abrasive wear reduces the strength and the safe minimum O.D., and makes the bearing faces eccentric. When so worn, they are repaired by using sleeves—as shown above. One producer of such equipment brought a problem to B&W—"How could this 'sleeve' job be done with a minimum cost in equipment, operations, material and time?"

Because of the diversity of its types of tubular products and experience in matching tubes to jobs B&W was able to supply tubing in the proper type, size and grade and with appropriate tolerances and physical properties. This, in turn, reduced the number of fabricating operations and eliminated excessive machining and the need of some fabricating equipment. This manufacturer was able to "repair and place in as good as new condition" these rather expensive products—and at a substantial reduction in cost.

Friendly Mr. Tubes—your link to B&W—is the man to call when tubing can save the day in your own operation. His business is matching tubes to jobs—jobs like yours. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

TA-6106-M6

Seamless and welded tubular products, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels.



CARBOLOY
MACHINABILITY COMPUTER

- Ends time-consuming tryout runs; saves valuable stock
- Shows you how to get maximum machine output at lowest cost

JUST DIAL IN KNOWN MACHINING DATA... SOLVE TOOL SETUP PROBLEMS IN SECONDS

The Carboloy Machinability Computer accurately predicts how your tools and machines will perform on any job. Faster than any other method of figuring job setups, it calculates the effect of 19 basic machining variables on machine performance, tool life, and output.

With this information, you can check the accuracy of existing setups, determine new machining standards, eliminate costly pilot runs. With the Computer, you can quickly see how to vary operating conditions to gain maximum efficiency from the cutting tool, the machine, and the operator. Simply set up the known machining variables on the Computer dials . . . then adjust the unknown variable until the Computer shows that the correct setting has been reached.

Hundreds of Carboloy Machinability Computers are now in use throughout industry . . . on jobs ranging from initial setups to trouble-shooting. The Computer is portable and rugged; priced at $495 (f.o.b. Detroit). For more information, or a demonstration in your plant, write: *Metallurgical Products Department of General Electric Company, 11147 E. 8 Mile Blvd., Detroit 32, Michigan.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

How a better precision-fit Guide Pin Bushing* is made in less time with

SHELBY SEAMLESS MECHANICAL TUBING

Here is another manufacturer that is turning out a better product in less time by using Shelby Seamless Steel Tubing.

The product, a wring-fit bushing, makes possible a truly precision die set, which permits closer working tolerances and extends the life of the dies to a degree never before thought possible. The bushing itself is harder, stronger, more uniform, longer lasting and better fitting.

When Shelby Seamless Tubing is used, no boring is necessary—the hole is already there. It offers more, however, than just a pre-bored hole. It combines to an exceptional degree the qualities of strength, uniformity, and dimensional accuracy. These advantages, coupled with the workability and excellent machining properties of Shelby Seamless, make it the ideal material for critical mechanical applications like this.

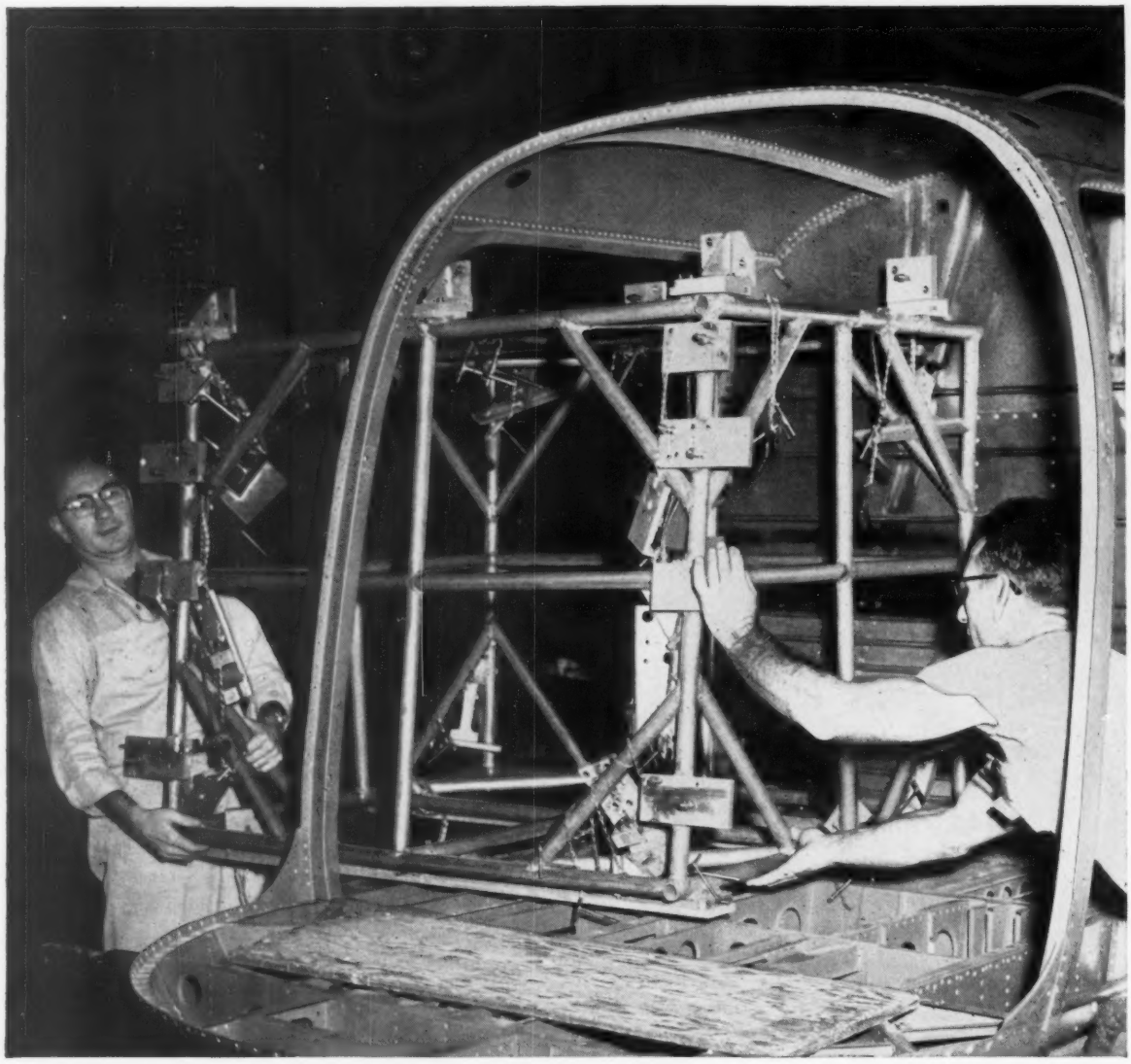
Available in a wide range of diameters, wall thicknesses, various shapes and steel analyses, Shelby Seamless Mechanical Tubing is produced to exacting standards by the world's largest manufacturer of tubular steel products. Get in touch with our engineers if you would like help in applying Shelby Seamless to your specifications.

*Manufacturer's name on request.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS SHELBY SEAMLESS MECHANICAL TUBING

UNITED STATES STEEL



TWO MEN can easily maneuver this lightweight magnesium tool out of the cabin.

"Light magnesium tool helps precision-build Bell 'copters"

"Various parts and sub-assemblies of a helicopter cabin must be precision located in order to achieve accurate assembly results," says Mr. C. D. Riley, supervisor of standards in tool design, Bell Aircraft Corporation.

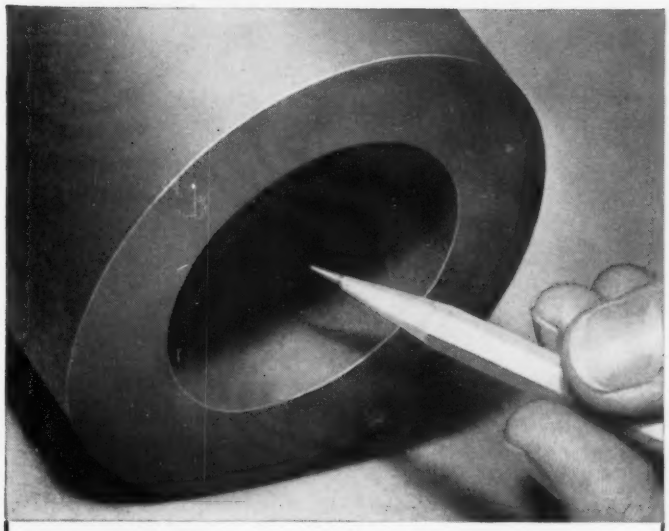
"To assure accuracy, we use a supporting tool frame to hold the various parts in position while being joined. So we built the supporting frame of magnesium. Weighing only 112.5 lbs., it meets our every requirement for accuracy.

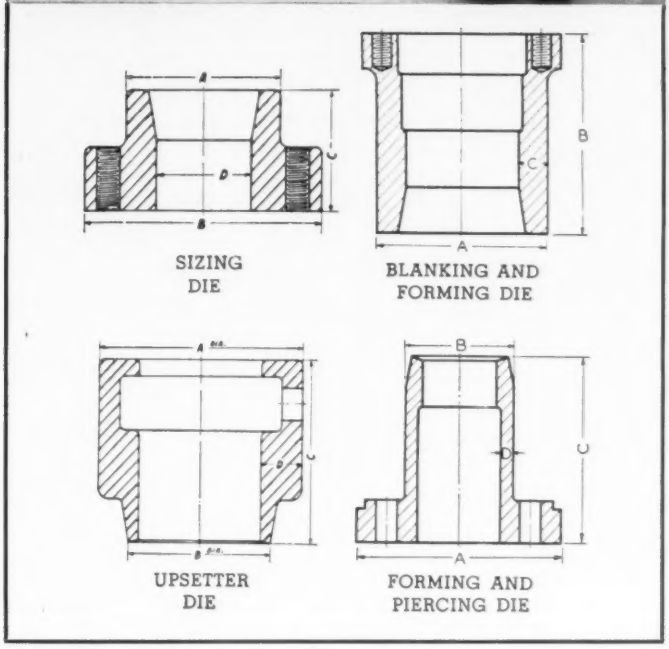
"A steel or aluminum frame weighing as much as 300 or 400 lbs. would deflect the floor of the cabin beyond the allowable limits of plus or minus .010 inch at critical attach points resulting in poor fitting of doors, plexiglas bubble and other components." For information on weight-saving, readily welded magnesium tooling plate and extrusions, contact your nearest supplier of Dow Magnesium, or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 1415V-1.

AVAILABLE FROM STOCK AT: Copper and Brass Sales, Inc., Detroit, Michigan • Fullerton Steel and Wire Co., Chicago, Ill. Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif. Vinson Steel and Aluminum Co., Dallas, Texas.

YOU CAN DEPEND ON DOW

SPEED PRODUCTION, CUT WASTE WHEN MAKING RING-SHAPED TOOL STEEL PARTS





New Graph-Mo® Hollow-Bar eliminates drilling, machines 30% faster

IF you make ring-shaped tool steel parts, you'll find that you can speed production, cut waste, and save steel by using Graph-Mo® Hollow-Bar. That's because Graph-Mo Hollow-Bar comes with the hole already in it. There's no drilling. You start with finish boring.

And with Graph-Mo Hollow-Bar you get the combination of proved advantages that have made Graph-Mo one of the most popular tool steels: excellent machinability, exceptional wearability, unsurpassed stability.

Actual tests prove that Graph-Mo machines 30% faster than other tool steels. That's because Graph-Mo has free graphite in its structure. And this free graphite gives Graph-Mo less tendency to pick up, scuff, and gall.

Graph-Mo's amazing wear resistance stems from a combination of graphite and diamond-hard carbides. Reports from users indicate that Graph-Mo outwears other tool steels on an average of three to one.

Graph-Mo also is the most stable tool steel ever made. A master plug gage made from this steel showed less than ten millionths of an inch dimensional change after 12 years in use. And Graph-Mo responds uniformly to heat treatment, too.

Makers of ring-shaped tool steel parts may obtain Graph-Mo Hollow-Bar in sizes from 4 to 16 inches O.D. with various wall thicknesses.

To learn more about Graph-Mo Hollow-Bar, and its application to your problems, write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN *Fine Alloy* STEEL

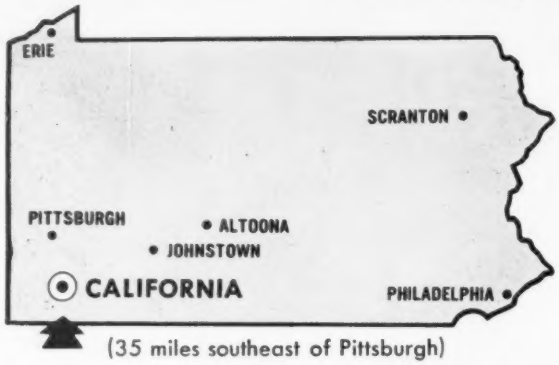
TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

For more information fill in page number on Inquiry Card, on page 241

100% financing

for your new plant on this community-owned industrial site in California, Pennsylvania



(35 miles southeast of Pittsburgh)

Ideal for steel fabricators, process industries or others needing large amounts of water, Ohio River barge transportation, or low cost coal supply.

This site is located on the navigable nine foot channel of the Monongahela River. It comprises 25 acres and features the facilities listed below:

RIVER—1400 foot frontage on Monongahela River—barge service by three well established concerns—barge docks readily available.

MOTOR FREIGHT—eleven carriers serve the area—daily pickup and delivery service by Railway Express.

UTILITIES—abundant electrical power by West Penn Power Company—high pressure natural gas service by Manufacturers Light and Heat Company—water and sewerage by Borough of California.

LABOR—ready availability of skilled and unskilled workers.

RAILROAD—Pennsylvania Railroad siding in place—daily switching available.

HIGHWAYS—state and U. S. routes—direct access to Pennsylvania Turnpike. Distances to:

CLEVELAND	157 miles	BALTIMORE	211 miles
DAYTON	255 miles	COLUMBUS	186 miles
WHEELING	56 miles	CINCINNATI	291 miles
NEW YORK	362 miles	PHILADELPHIA	283 miles
		BUFFALO	269 miles

This is one of many industrial sites, ready for use, being developed throughout Pennsylvania by active industrial development organizations such as the Central Monongahela group.

For additional information on this or other sites, for a copy of "Plant Location Services" booklet, or for additional details on how the PENNSYLVANIA PLAN can provide 100% financing for your new plant, write or call:

Pennsylvania Department of Commerce
Main Capitol Building, 563 State Street
Harrisburg, Pennsylvania
Phone: CEdar 4-2912

Special reports and tabulations, tailored to your specific location requirements, will be prepared upon request by engineering and economics specialists, covering:

Labor—Availability, skills, rates, surplus areas.

Markets—Consumer, industrial product, state, regional.

Transportation—Water, rail, truck, air transit time, costs.

Buildings—Availability, sizes, location, descriptions.

Sites—Acreage, topography, utility services, photos, maps; industrial districts.

Financing—Community-state industrial building program, lease-purchase, commercial credit.

Materials—Metals, industrial chemicals, wood, textiles, farm products.

Minerals—Location, reserves, potentials, analyses.

Water—Quantitative, qualitative analyses.

Power—Capacity, network, industrial services, costs.

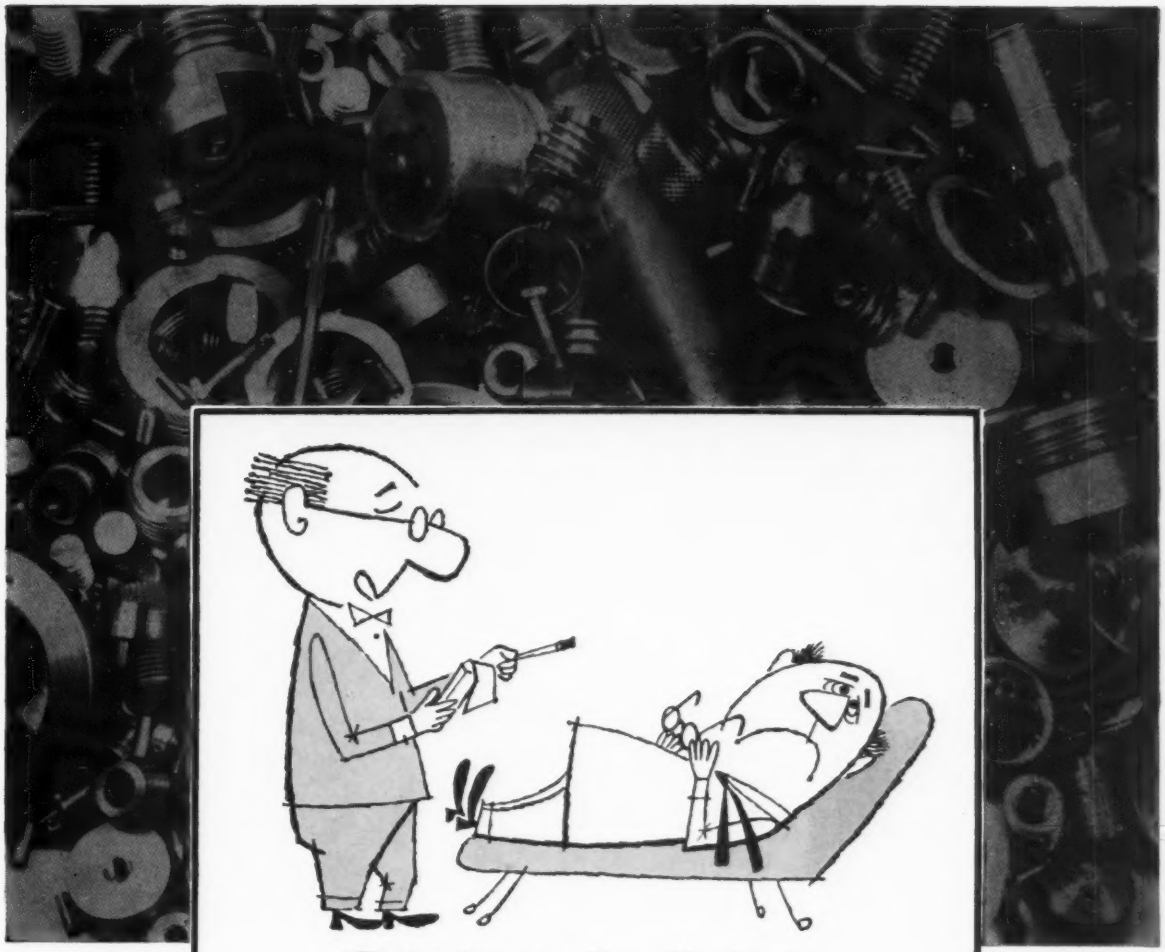
Fuel—Coal, oil, natural gas service, costs.

Engineering—Schools, enrollment, specialization, research laboratories, services.

Taxes—Inter-state and community comparisons, assessment ratios, millages, corporate.

Communities—Characteristics, size, regions, housing, schools, culture, recreation.

Industrial Representatives Available for Inspection Tours, Conferences and Consultations



"There's nothing wrong with you, Mr. Abernathy, that a switch to MX won't cure"

Are you suffering from high production costs? Low tool life? A rise in rejects? Or a falling off in finish? USS MX Free-Machining Steel offers a sure cure for these depressing conditions.

With this faster-cutting bar stock you not only can produce more parts per hour but you'll turn out *better* parts. Better in finish, more accurate in dimension, lower in cost. Tool life will be longer. You'll have fewer rejects to cut into your profits. It's been proved in shops where USS MX has been put to work.

Such highly desirable results are obtained with MX Steel primarily because of its superior machinability. Also because this steel is consistently uniform in shipment after shipment. Uniform in cutting characteristics. Uniform in its composition. Uniform in freedom from injurious imperfections.

USS MX Steel works *with* your tools, not against them. That's why, on many jobs, tools have lasted up to 200% longer, cutting speeds have increased as much as 50%, output has been boosted an average of 40%. And remember, with all these advantages, *MX Steel costs no more than ordinary screw stock.*

Available in both Bessemer and Open Hearth grades, USS MX Free-Machining Steel is produced in all the popular screw stock sizes. It is sold in cold-finished form by your regular supplier, under either our trademark "MX" or his own identifying mark. In hot-rolled form, MX Steel is available through our nearest sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Bigger output . . . longer tool life . . . lower costs

USS

—when you do the job with free-machining

MX

Registered trademark

UNITED STATES STEEL

Vibration won't loosen FLEXLOC self-locking nuts

Where products must be reliable . . . must stand up under vibration, temperature extremes and hard use . . . designers specify rugged, reliable, precision-built FLEXLOC self-locking nuts.

HERE'S WHY:

FLEXLOC locknuts are strong: tensile strengths far exceed accepted standards. They are uniform: carefully manufactured to assure accurate, lasting locking action. And they are reusable: repeated removal and replacement, frequent adjustments, even rough screw threads will not affect their locking life.

Standard FLEXLOC self-locking locknuts are available in a wide range of standard sizes, types and materials to meet the most critical locknut requirements. Your local industrial distributor stocks them. Write us for complete catalog and technical data. Flexloc Locknut Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

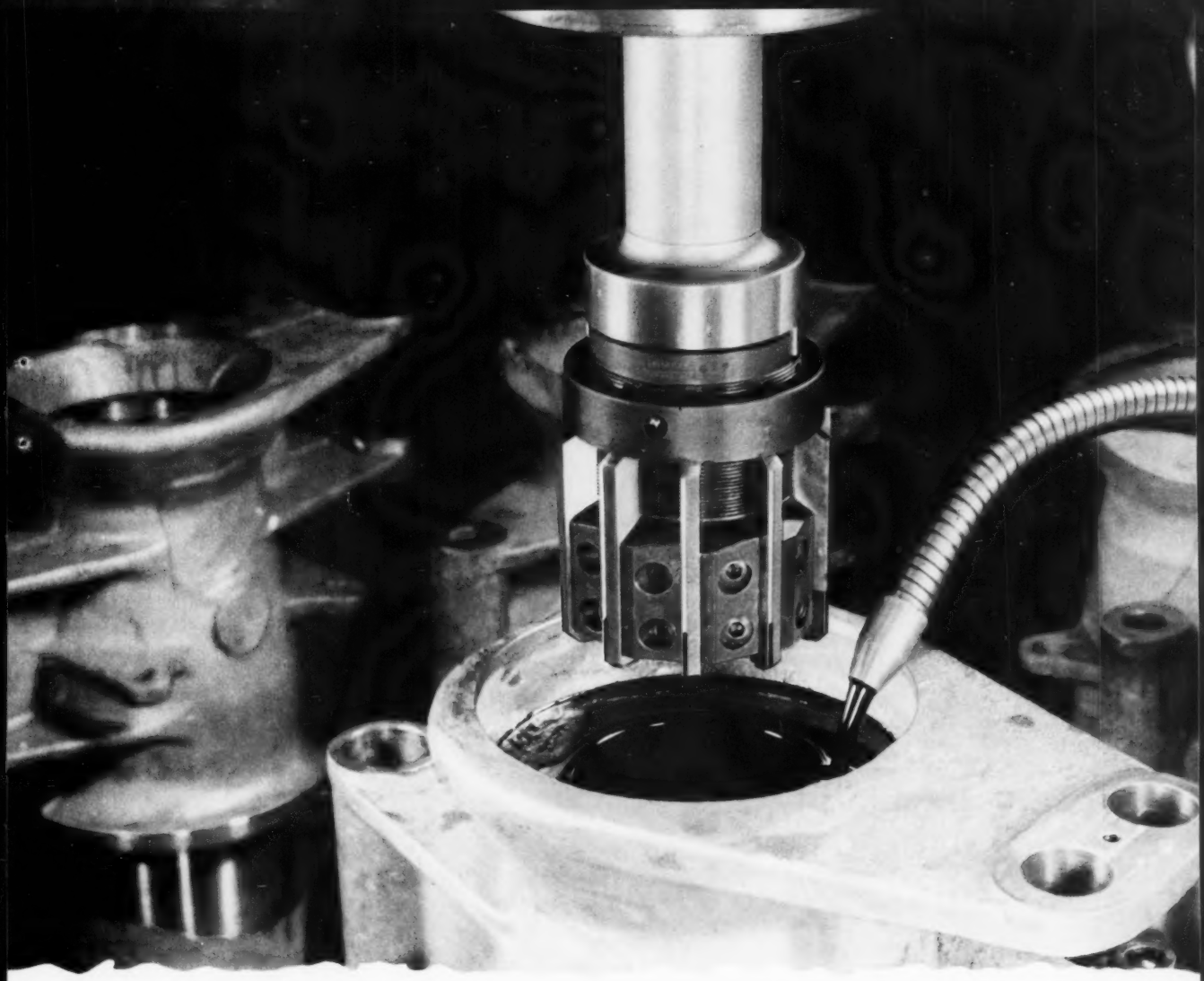
STANDARD PRESSED STEEL CO.

FLEXLOC® LOCKNUT DIVISION

SPS

JENKINTOWN PENNSYLVANIA

For more information fill in page number on Inquiry Card, on page 241



TOOL LIFE INCREASED 400%

CLEVELAND Carbide Tipped Adjustable Reamer sets new high record!

The specifications on this job call for reaming a 4½" hole to a tolerance of .001" and a surface finish of less than 50 R.M.S. (micro-finish). CLEVELAND Carbide Tipped Adjustable Reamers are meeting these requirements day after day... month after month... *and reaming five times as many holes per grind as the conventional high speed reamers formerly used.*

Whenever *you* have a difficult reaming problem, a CLEVELAND Service Representative can help you. Contact our nearest Stockroom, or...

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

Request your copy of this descriptive booklet on CLEVELAND Carbide Tipped and Solid Carbide Cutting Tools

THE CLEVELAND TWIST DRILL CO.

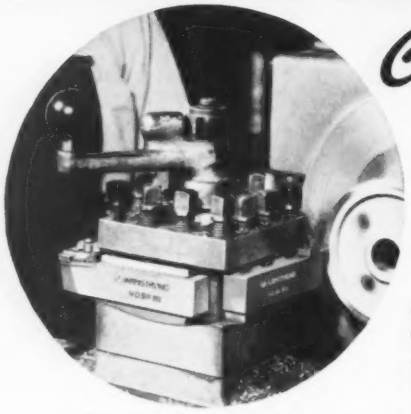
1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

E. P. Barrus, Ltd., London W. 3, England

ARMSTRONG

Carbide Insert TOOL HOLDERS



for use in clamp type rests

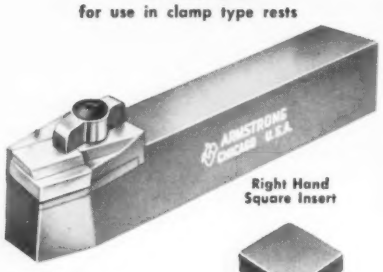
for use in conventional tool holders

The ARMSTRONG System of Tool Holders gives the advantages of (NO GRINDING) "throw-away" insert tooling for all metal turning—for tool room, machine shop and maintenance lathes as well as for production machine tools. Included in the Armstrong System are ARMSTRONG Carbide Insert Tool Holders with shanks to fit in conventional tool posts and for clamp rests of all sorts. Both types are provided in a wide range of sizes to hold either "square" or "triangular" carbide inserts. Both types come in right-hand or left-hand styles. For Carbide Insert Tool Holders exactly suited for a specific need or piece of equipment, standardize on ARMSTRONG Tools.

Special ARMSTRONG design features include: (1) Fast convenient clamping which permits rapid indexing of inserts, (2) replaceable hardened tool steel seat ground to provide a flat base for inserts, (3) accurately machined heat treated alloy steel shanks for extra strength and rigidity.

Because ARMSTRONG Armide Inserts as well as ARMSTRONG Carbide Insert TOOL HOLDERS are carried in stock by leading Industrial Distributors they are as available as your telephone—single tool sets or a selection of sizes.

Write for catalog sheets.

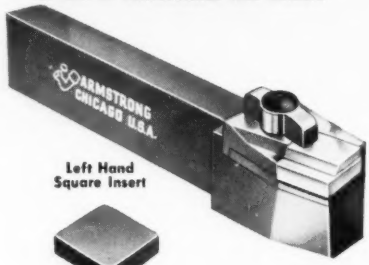


Right Hand Square Insert

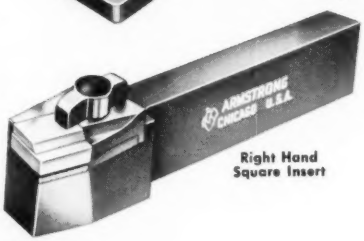
Left Hand Square Insert

Right Hand Triangular Insert

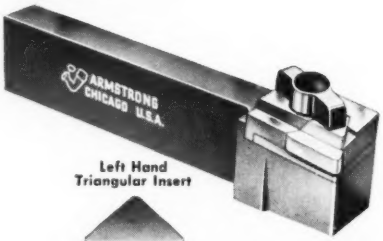
Left Hand Triangular Insert



Left Hand Square Insert



Right Hand Square Insert



Left Hand Triangular Insert

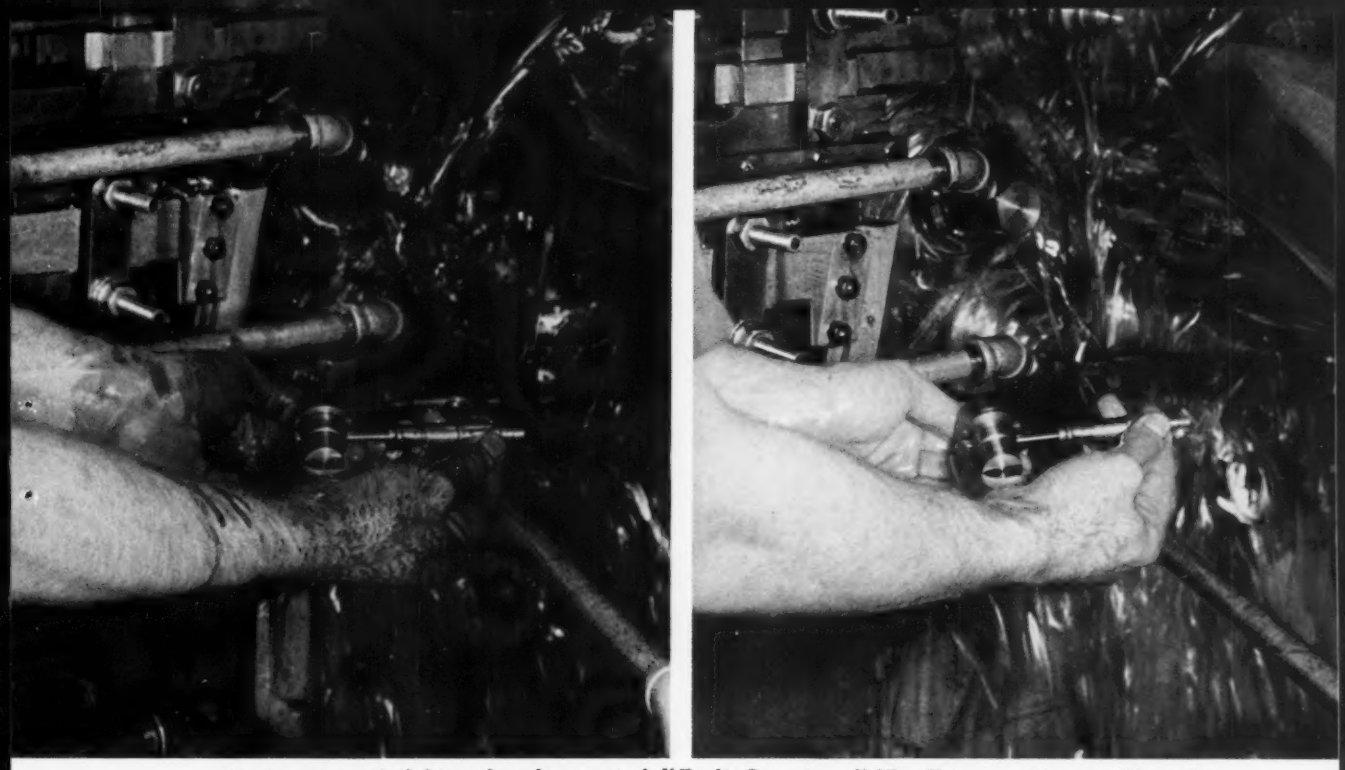
Right Hand Triangular Insert

Buy ARMSTRONG TOOLS from your Industrial Distributor

ARMSTRONG BROS. TOOL CO.

5213 W. ARMSTRONG AVE. • CHICAGO 30, ILL.

For more information fill in page number on Inquiry Card, on page 241



Black cutting oil (left) makes close control difficult. Operators dislike dirty operating conditions it creates. Close control is easier and workers are happier with transparent Sunicut cutting oil (right).

WHY USE A BLACK CUTTING OIL WHEN YOU DON'T NEED IT?

Sunicut oils give you better visibility without sacrificing machining efficiency.

When trying to maintain close control over machines producing precision parts, operators can be handicapped by "black-oil blindness". It is hard to see the tools, the workpiece, and the finishes. Checking close tolerances is difficult when the graduations on micrometers and gauges are obscured.

Worse still, as the operator sees it, are the dirty working conditions caused by dark oils. His clothes get saturated with hard-to-remove stains, and his hands are black from one end of the shift to the other.

Transparent Sunicut oils help keep your operators happy and will make close control easier ...and transparent Sunicut oils will do the job with no sacrifice in machining speed or finishes.

To get the full story on Sunicut oils, see your local Sun representative, or write SUN OIL COMPANY, Philadelphia 3, Pa.. Dept. I-41.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

© SUN OIL CO.

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

PACKAGED

For any machining or grinding operation...

THERE'S A SUN OIL THAT'LL GIVE YOU HIGH EFFICIENCY AND LOW OVER-ALL COST

No two machine shops have exactly the same problems when it comes to selecting cutting oils...even when they're running the same job. And, until somebody comes up with the truly universal cutting oil, you can't afford to disregard the importance of oil selection. Here's how Sun can help you.

First, Sun makes a complete line of emulsifying and straight cutting and grinding oils. Second, your Sun representative, backed up by field engineers, has the necessary practical experience to recommend the oil that will give you both high machining efficiency and low over-all costs.

For the full story about Sun's cutting oils, see your Sun representative...or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-42.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

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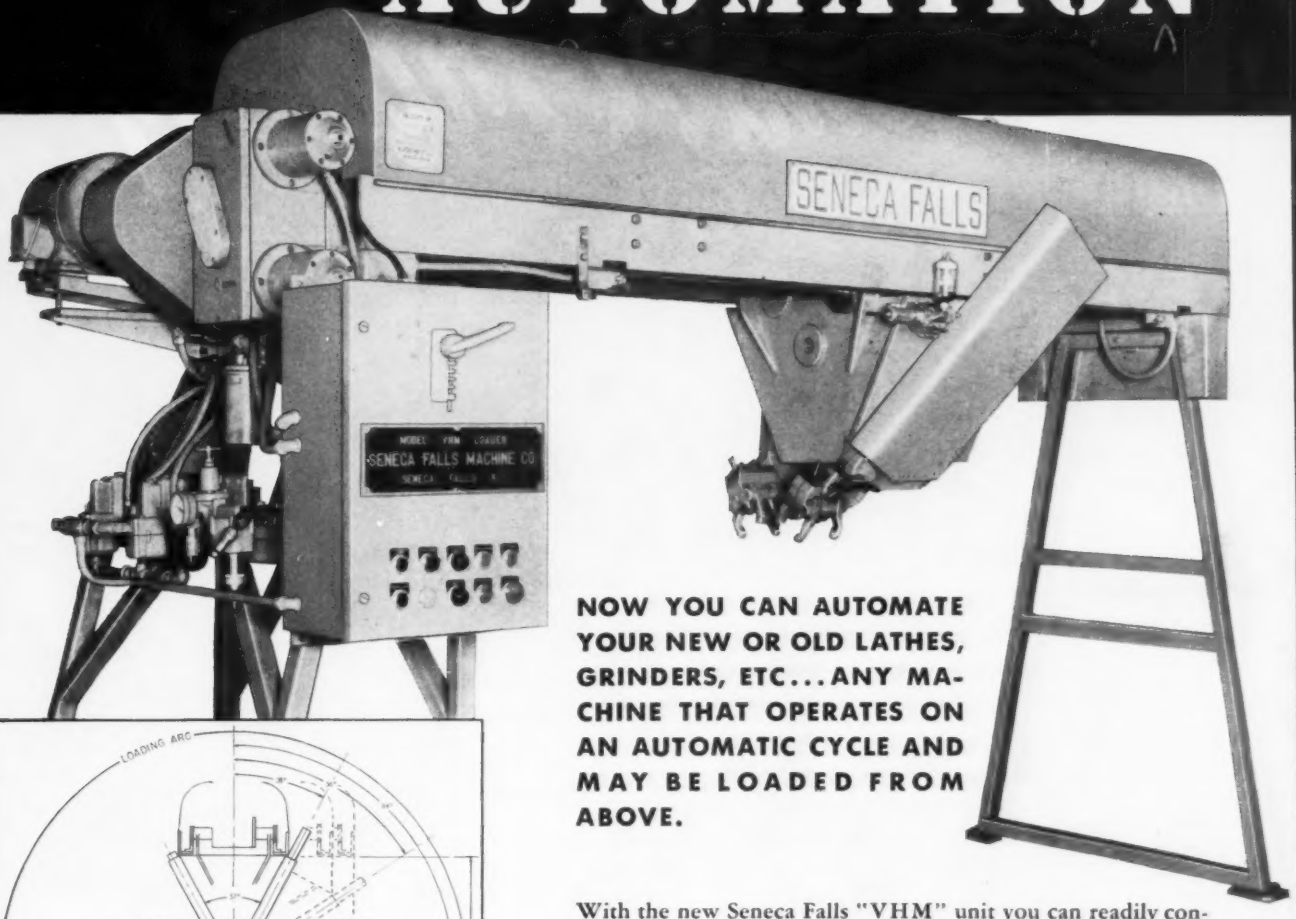
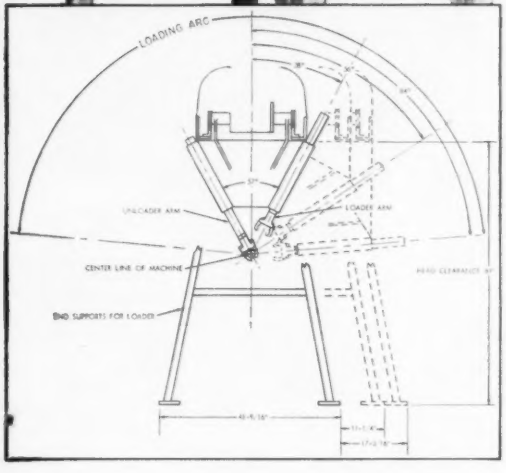
IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

PACKAGED AUTOMATION



NOW YOU CAN AUTOMATE YOUR NEW OR OLD LATHES, GRINDERS, ETC... ANY MACHINE THAT OPERATES ON AN AUTOMATIC CYCLE AND MAY BE LOADED FROM ABOVE.



With the new Seneca Falls "VHM" unit you can readily convert your existing automatic cycle machines into a single automated production line with minimum pain or strain. Since all movements are purely mechanical, installation and maintenance of equipment are simple and require no knowledge of electronics.

Put these advantages to work for you:

- **Wide range adaptability.**
- **Lower handling costs per piece.**
- **More production per hour.**
- **No operator fatigue.**
- **Fewer operators per production line.**
- **Fewer "human reflex" accidents.**
- **Simplification of plant layout.**
- **Standardization of Loader and Transfer Equipment.**
- **Quick change-over.**
- **Low maintenance costs.**

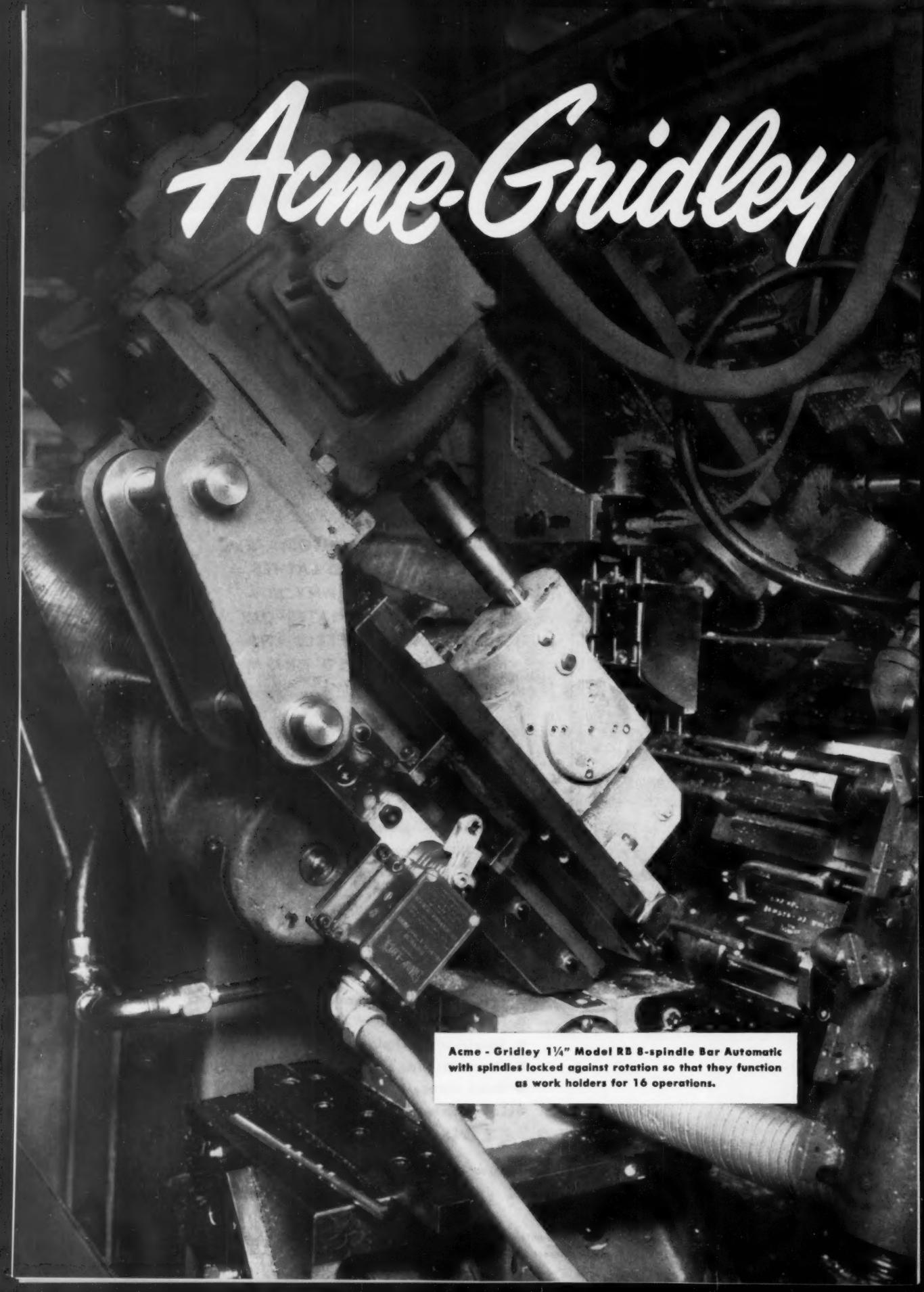
Phone, wire or write for all the facts

SENECA FALLS MACHINE CO.
Seneca Falls, New York

SENECA FALLS MACHINE

ENGINEERED FOR PROFIT

Automatic and Semi-automatic Lathes • Automatic Drilling and Centering Machines
Automatic Work Drivers • Production Tracer Lathes • Automation and Work Handling Devices • Special Production Machinery

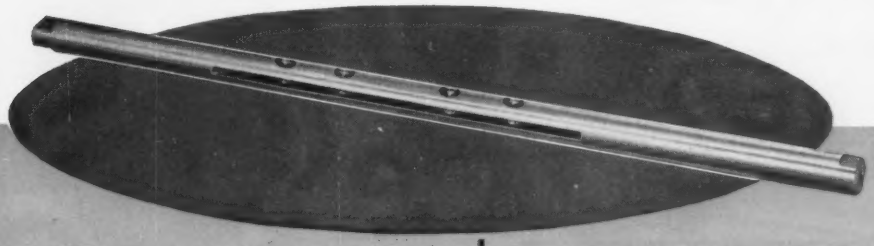


Acme - Gridley 1¼" Model RB 8-spindle Bar Automatic with spindles locked against rotation so that they function as work holders for 16 operations.

basic design + proper tooling

. . . reduces machine investment 75%

. . . reduces cost-per-piece 90%



This customer wanted to determine the quickest and most economical way to make double-barrel carburetor shafts. NAMCO engineers recommended a procedure that resulted in his producing these shafts at one-tenth the previous unit cost and on a machine that required but one-fourth the equipment investment needed to accomplish the job by in-line manufacturing methods.

Selected to do the job was a standard 1¼" RB 8-spindle Acme-Gridley bar automatic. Each of its eight spindles was locked against rotation so that it functioned as a work holder as the machine indexed the work from position to position. Because accurate indexing is one of the inherent features of Acme-Gridley basic design, it assured proper alignment of the work with the standard and special attachments on the end and side toolslides. This permitted holding the close tolerances required on the part while performing the 16 operations indicated on the tooling diagram shown at the right.

* * *

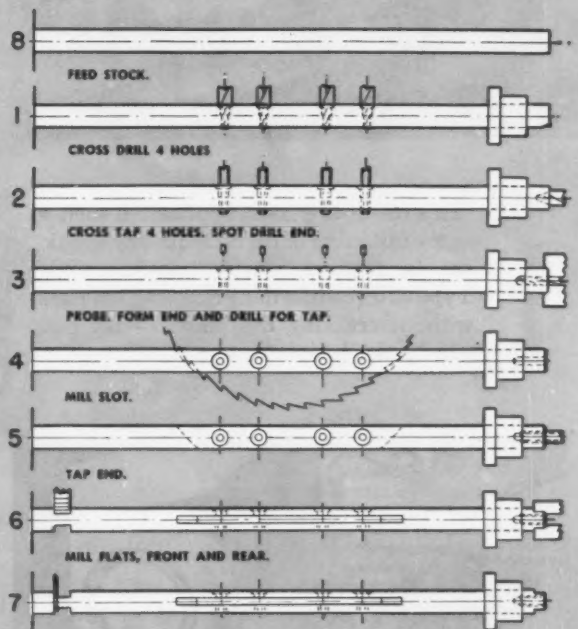
WRITE FOR YOUR FREE COPY OF TP-44. It shows how maximum production versatility and cost reduction can be realized in your manufacturing operations.

JOB FACTS

PART.....Carburetor Shaft **MACHINE TIME....6.7 Seconds**

MATERIAL.....Brass **GROSS PRODUCTION 533 per hr.**

NUMBER OF OPERATIONS.....16



why don't you

INDEX . . . to lower machining costs . . .

with *Acme-Gridley*

CONTROLLED CYCLE

National Acme

THE NATIONAL ACME CO.
179 EAST 131ST STREET
CLEVELAND 8, OHIO

Sales Offices . . . Newark, N. J. . . . Detroit, Mich. . . . Chicago, Ill.

here's how Seeburg matches P-K® fasteners to the job

And Parker-Kalon's wide range of types and sizes makes it possible

"By carefully selecting the right P-K screw for each assembly we've reduced rejects and stepped-up production," says Joseph Kamys, engineer of J. P. Seeburg, manufacturers of the famous line of Select-O-Matic "200" Coin Operated Phonographs.

◂ "Take the fastening of metal kickplates and base moldings to wood cabinets, for example. They must hold permanently and go in fast without splitting the wood. P-K Type-A Self-tapping Screws are just right for the job."

"In a metal-to-plastic application such ▸ as the fastening of high-frequency speakers to formed plastic housings—P-K Type-Z thread-forming Screws go in right without cracking the plastic—stay put, even under high vibration."

◂ "In this important subassembly, appearance is important as well as dependable holding power. Here we use P-K Type-A Phillips Recessed Head Screws in a metal-to-metal application."

Whatever your product or application . . . ferrous or non-ferrous castings, sheet metal or structural steel, plywoods, asbestos compositions, pliable or brittle plastics . . . Parker-Kalon can furnish the proper fastener to speed assembly, reduce rejects, cut costs!

PARKER-KALON®
fasteners

Sold Everywhere Through Leading Industrial Supply Distributors.

PARKER-KALON DIVISION, General American Transportation Corporation. Factory: Clifton, New Jersey.

Five small Farval systems protect world's largest adjustable-rail milling machine

FARVAL—
Studies in Centralized Lubrication
No. 199

KEYS TO ADEQUATE LUBRICATION—
Trailer truck and car illustrate the tremendous size of this great machine tool. Red key-arrows indicate two of five Farval systems. Whenever you see this sign of Farval you know a machine is being properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.

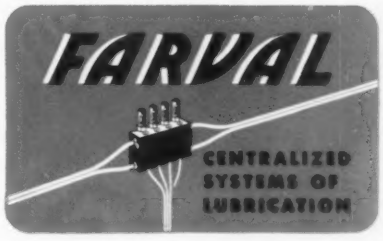
THIS 615-ton milling machine, installed at Schenectady, machines steam-turbine-generator parts up to 18 feet wide and 16½ feet high to close tolerances.

Vital to its smooth operation are five manual Farval systems which lubricate the rail nuts on the cross rail. Two of them are visible in the photograph. With Farval, accurately measured amounts of oil or grease can be delivered to bearings whenever needed.

Five small Farval systems are an insignificant part of the cost of protecting the $1.5-million investment in this world's largest milling machine.

You, too, can protect your machines inexpensively with Farval. Why not investigate, then invest! Just ask for Bulletin 26-S. Our representative will call at your convenience. The Farval Corporation, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.



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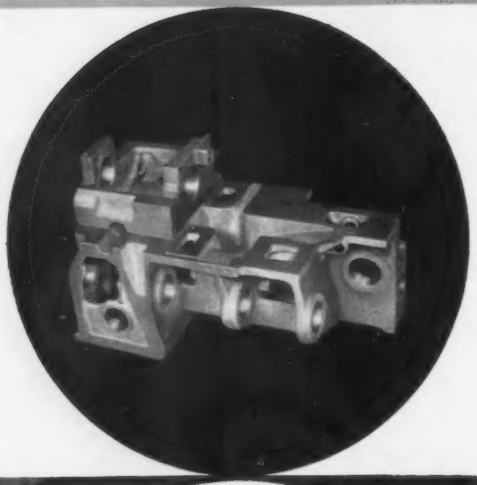


At Brown & Sharpe

Natcos Help From

At Brown & Sharpe, a 22-spindle Natco 3-way Machine handles finished drilling, boring and reaming on "00" screw machine beds

NATCO

Slash In-Process Time 16 Weeks to One Week

On Automatic Screw Machine Beds

Even on precise machine tool parts, traditionally handled on a "job-shop" basis, Brown & Sharpe gained great advantage by installing an automatic line. Prominent in the line are two Natcos, engineered and tooled to handle all drilling, boring and reaming on either the No. 00 or No. 2 automatic screw machine beds.

One Natco does all roughing—the second handles finishing. Total of 62 operations. Each Natco is tooled to process two parts at once—tooling is interchangeable to accommodate either sized bed.

Extreme machine tool accuracy must be maintained throughout. In one operation the Natco drills through five walls, holding centers parallel to the locating surface within .0015" for the full 42" distance. In another case, Natco engineering devised a tooling leaf that automatically drops through a core in the part, providing internal boring bar support.

Natcos make sense even on "job-shop" jobs. Call in a Natco Field Engineer—he can quickly tell you whether a Natco can be a cost-saver on your next job.

National Automatic Tool Company, Inc.

Richmond, Indiana ***Multi-spindle drilling, boring, and tapping machines. Special machines for automatic production.***

Call Natco Offices in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland, Los Angeles; distributors in other cities.

dixi 60

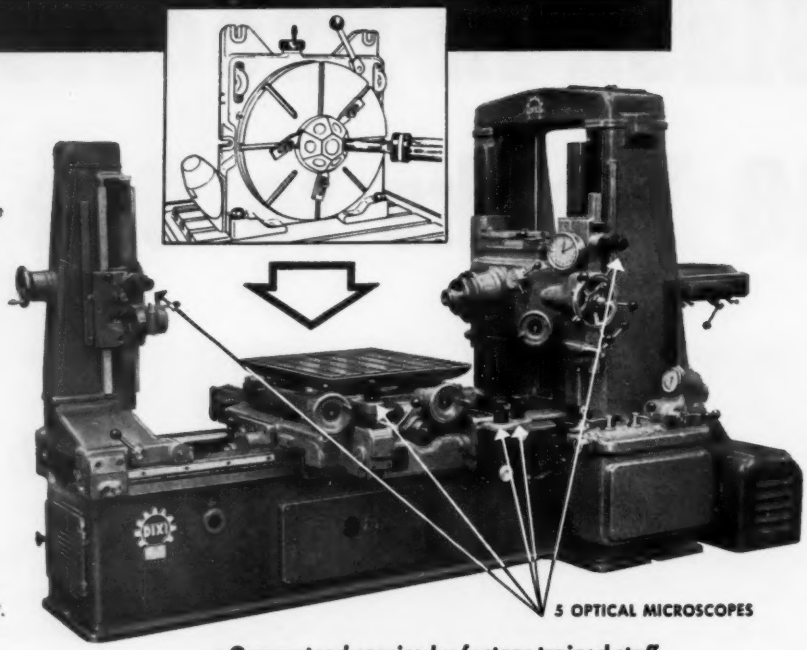
horizontal optical jig borer

with 5 optical microscopes

DESIGNED AND BUILT FOR:

VERSATILITY
Optical settings for operations in all planes and compound angles . . . Equally suitable for tooling, short-run or production work . . .

ACCURACY
Overall accuracy of .0002"



A precision machine for *JIGLESS* boring, facing, milling, and drilling work, in all planes. Built-in 360° optical rotary table, 28¾" x 32⅝". All spindle and table settings by optical microscopes. Infinitely variable hydraulic feeds. Mechanical spindle feeds with automatic depth stop. #40 taper spindle-speeds infinitely variable to 1400 R.P.M. Special features eliminate effect of spindle overhang on accuracy.

DIXI 450 PRECISION OPTICAL CIRCULAR DIVIDING TABLE

Direct readings of 1 sec.

(See insert picture above) rigidly mounted (not tilting) on built-in rotary table permits holding close tolerance relations between bores in all planes, including bores at compound angles. ALL IN ONE SET-UP. All sides of the work piece except the mounting face machined in one set-up.

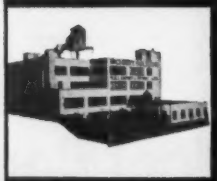
- ***Guaranteed service by factory trained staff***
- ***Engineering staff available for consultation***
- ***Spare Parts in New York stock***
- ***Your operators trained***

DIXI 60 now in wide use in leading Aircraft and Manufacturing Plants throughout the United States.

Names available upon request.

SEE THIS VERSATILE MACHINE IN OPERATION

at our New York or Cleveland Show Rooms. Write for Complete descriptive literature and prices to Department 21. Catalogues on additional production equipment also available on request.



Our Headquarters in New York City

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A Division of Machinery Builders, Inc.

475 Grand Concourse, Bronx 51, N. Y.

Over 20 years experience in designing & building machinery

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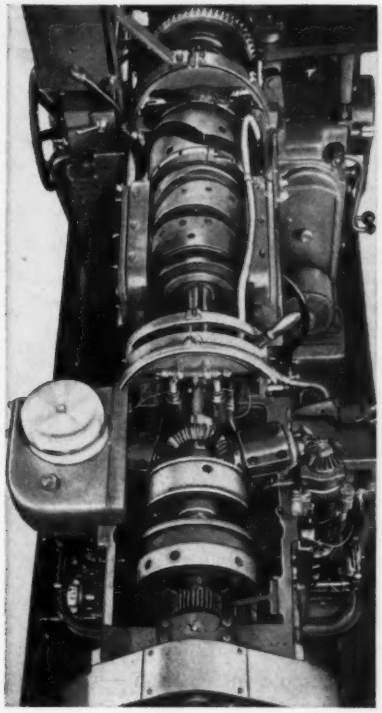
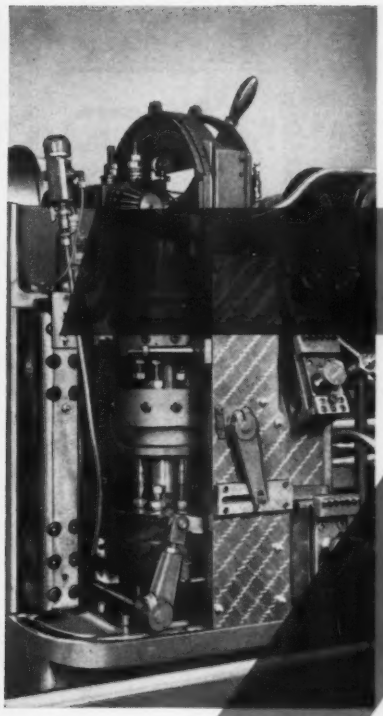


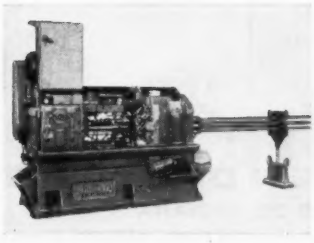


Seven Fast Changeover Models

With the prospects of improved tool materials ever decreasing the actual machining time of work on Multiple Spindle Automatics, long runs tend to become short runs. Facility that decreases the time for job changes becomes more important to low-cost production.

Conomatics are available in as many as seven fast changeover models. These are the 9/16", 1", 1⅝" Sixes, and the 2⅝", 3½", 5", and 5¼" Fours.

These models are equipped with dial adjustment of working stroke of all slides, without making necessary change of total stroke or positive stop settings. Write, wire, or phone for literature descriptive of these features and other facilities available to users, or prospective users.



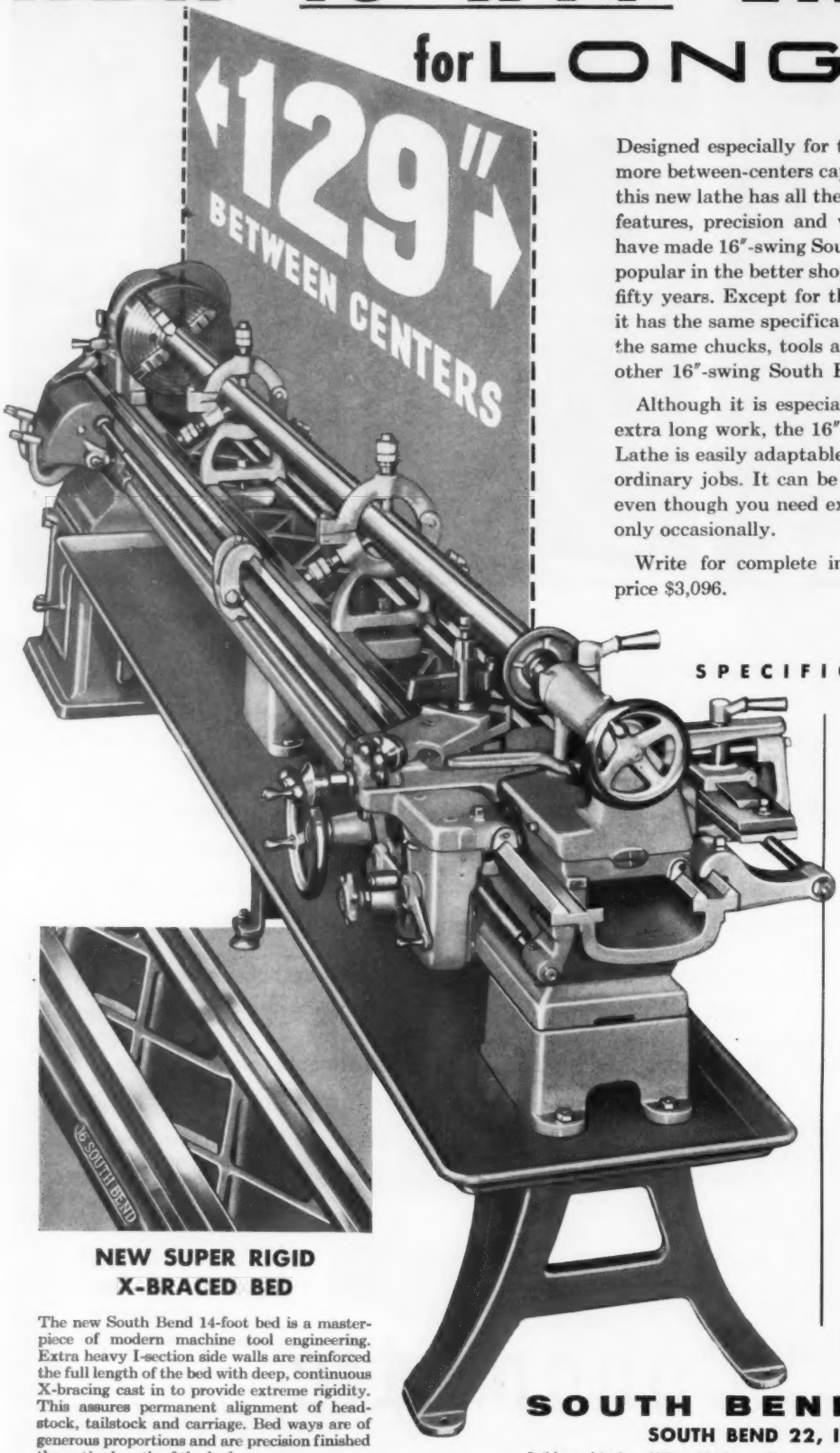
Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

For more information fill in page number on Inquiry Card, on page 241

NEW 16″ x 14′ LATHE

for LONG work



Designed especially for those who need more between-centers capacity (up to 129″) this new lathe has all the convenient features, precision and versatility that have made 16″-swing South Bend Lathes so popular in the better shops for more than fifty years. Except for the longer bed, it has the same specifications and takes the same chucks, tools and attachments as other 16″-swing South Bend Lathes.

Although it is especially suitable for extra long work, the 16″ x 14′ South Bend Lathe is easily adaptable to the more ordinary jobs. It can be busy all the time, even though you need extra capacity only occasionally.

Write for complete information — base price $3,096.

SPECIFICATIONS:

Capacity between centers.....129″

Swing over bed and saddle wings.....16¼″

Swing over saddle cross slide.....9⅝″

Spindle bore.....1⅜″

Collet capacity.....1″

Spindle speeds..(6 to 16) 15 to 980 r.p.m.

Power feeds, cross and longitudinal.....48 each

Thread cutting range .....48 pitches, 4 to 224 per inch.

NEW SUPER RIGID X-BRACED BED

The new South Bend 14-foot bed is a masterpiece of modern machine tool engineering. Extra heavy I-section side walls are reinforced the full length of the bed with deep, continuous X-bracing cast in to provide extreme rigidity. This assures permanent alignment of headstock, tailstock and carriage. Bed ways are of generous proportions and are precision finished the entire length of the bed.

SOUTH BEND

SOUTH BEND LATHE

SOUTH BEND 22, INDIANA

Builders of Lathes, Milling Machines, Shapers, Drill Presses and Pedestal Grinders

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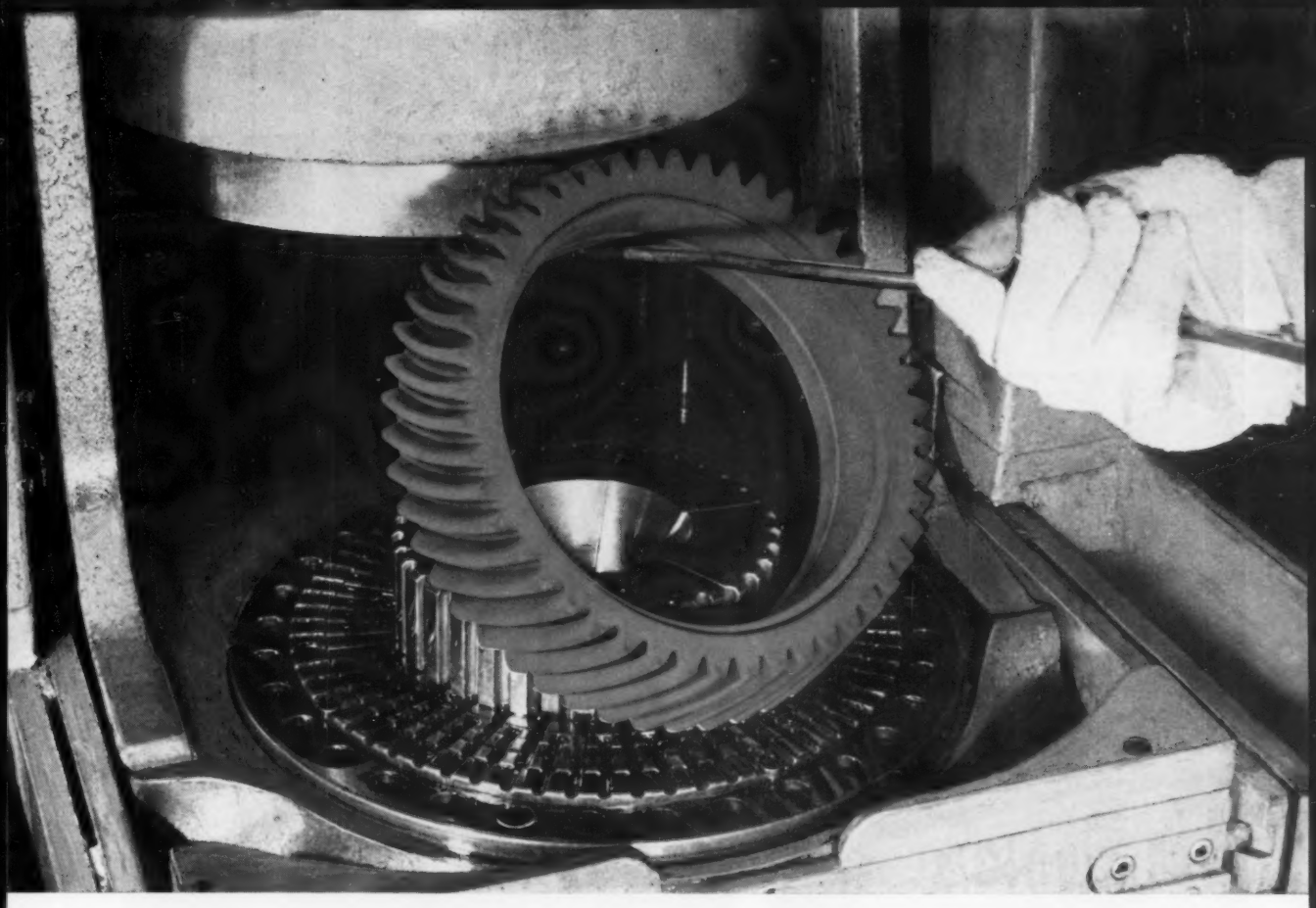


How to hold close tolerances when you quench gears and other parts

If you make parts like this aircraft transmission gear, you know that warpage or distortion during quenching means losing the time and money you've spent machining the part to close dimensional tolerances.

You can avoid such costly losses with Gleason Quenching Equipment.

The hot gear above, for example, is being set on the lower die of a Gleason Quenching Press. A button is pressed and the automatic quenching cycle is started. The lower die is swung back into the quenching position and the upper die descends rapidly, aligning the part while it is still in the plastic state.

The dies securely clamp the gear, but are so designed to permit it to contract in the normal manner, while still holding the gear true.

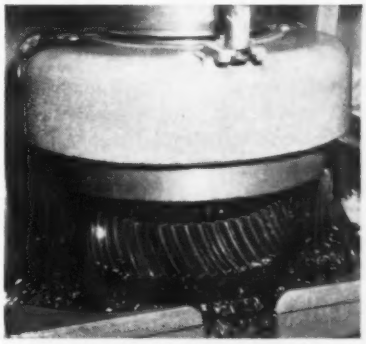
Carefully controlled, metallurgically correct oil circulation hardens the gear to perfection.

Post-quench tests show the gear meets all specifications.

You can give *any* part, regardless of shape, the same distortion-free quenching.

Three sizes of the Gleason Quenching Press harden parts up to 36″ diameter. Another press automatically hardens and straightens shafts and shaft parts up to 40″ in length.

For literature and recommendations on the press and die equipment that fit your products, send us blueprints.



The Gleason Quenching Press forces oil uniformly over and around the part, assuring the correct hardness and distortion-free quenching.

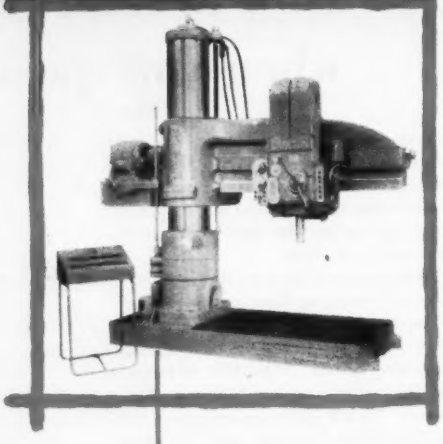
GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

Commodore John W. Anderson on the bridge of the luxury liner, UNITED STATES

Specialists do the job better: Smoother sailing guaranteed

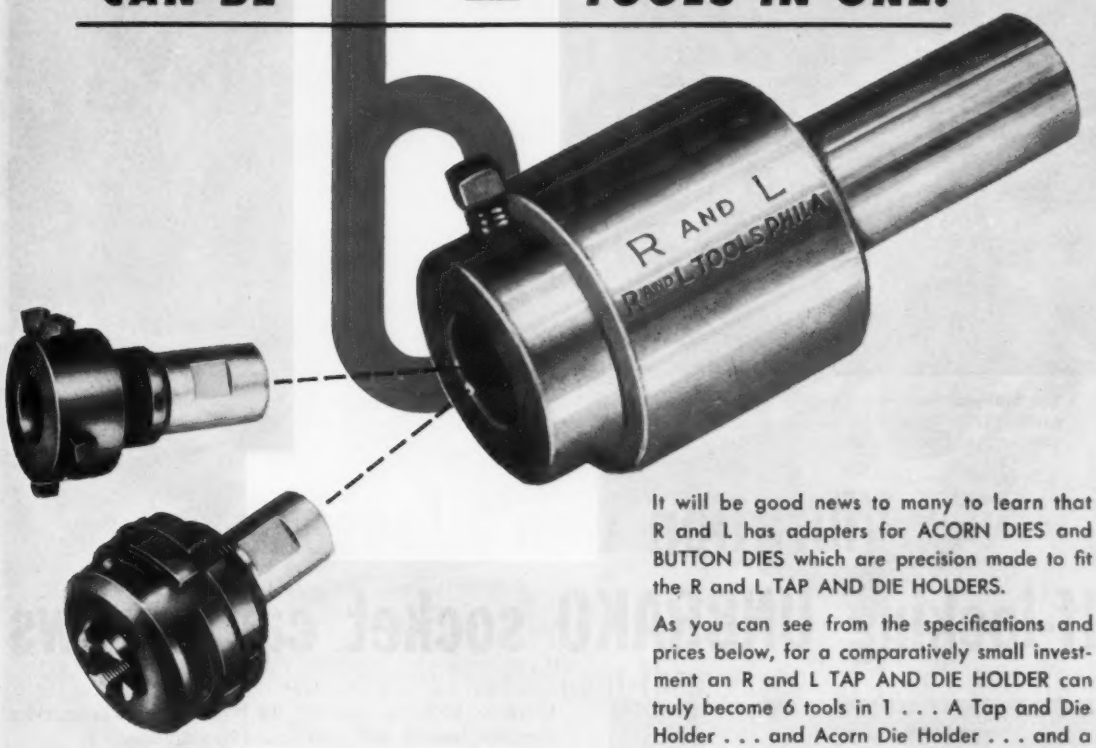


You sail through troubled waters with greater confidence when there's a specialist at the helm. Carlton has been providing smoother drilling by concentrating on radial drill research, engineering and manufacturing since 1916. This close contact with industry's drilling requirements has produced a wide line of the most modern and up to date radial drills. Made in arm lengths from 3-ft. to 12-ft., column diameters from 9″ to 26″. Programming, pre-select, partial pre-select and manual speed-feed controls, plus special bases, tables and jigs available for additional productivity. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton SPECIALISTS IN RADIAL DRILLS

THE R and L TAP AND DIE HOLDER

CAN BE 6 TOOLS IN ONE!



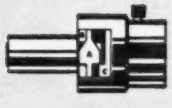


Figure 1.
Ready to start threading operation, clutch slightly engaged at C.

Figure 2.
Instantly engaged to full contact between A and C as soon as tap or die engages work.

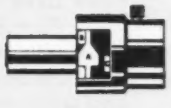


Figure 3
Fully released showing ample clearance between contact points of clutch preventing re-engagement or hammering of clutch points in case turret advances slightly after clutch releases.

It will be good news to many to learn that R and L has adapters for ACORN DIES and BUTTON DIES which are precision made to fit the R and L TAP AND DIE HOLDERS.

As you can see from the specifications and prices below, for a comparatively small investment an R and L TAP AND DIE HOLDER can truly become 6 tools in 1 . . . A Tap and Die Holder . . . and Acorn Die Holder . . . and a Button Die Holder . . . *For right and left hand threading!*

LEST YOU FORGET . . .

. . . The R and L TAP AND DIE HOLDER has an entirely new releasing mechanism, and can readily be changed for right or left hand threading. No spring plungers to wear or break. No small screws to work loose.

R and L TOOLS
1825 BRISTOL STREET • PHILADELPHIA 40, PA.

OTHER FAMOUS R and L TOOLS:

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES) UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

R and L TOOLS M-5
1825 BRISTOL ST., PHILADELPHIA 40, PA.

☐ Please send me your new catalog
☐ Please arrange for no-obligation demonstration of R and L TOOLS

NAME .....
COMPANY .....
ADDRESS .....
CITY ..... ZONE ..... STATE .....

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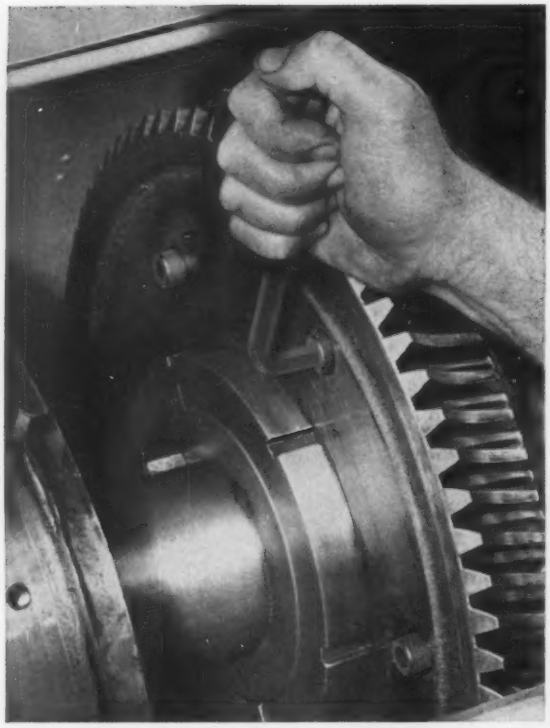
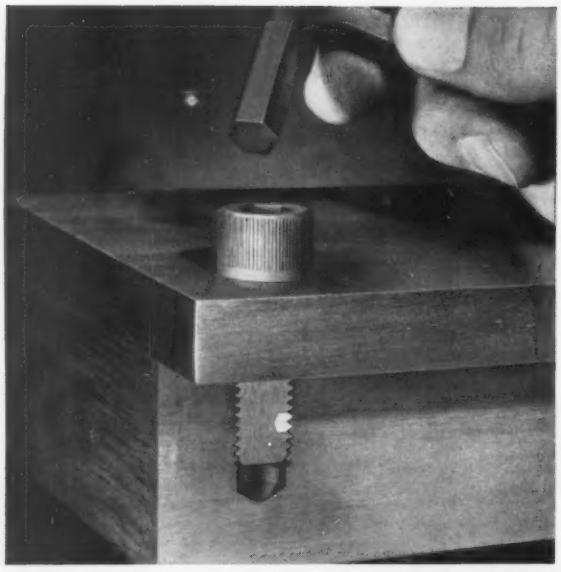


The ordinary fasteners securing the worm wheel to the drum shaft in this automatic screw machine loosened, causing $120 worth of damage to parts. Labor for the repair job cost $100. The ordinary fasteners were replaced with self-locking UNBRAKOS, and there has been no trouble since.

Vibration won't loosen self-locking UNBRAKO socket cap screws



HOW IT LOCKS. The tough, resilient Nylok locking pellet keys itself into the mating threads. It forces threads together and locks the screw securely—whether or not the screw is seated.

UNBRAKO socket screws with the Nylok* self-locking device eliminate fastener problems caused by vibration.

Take the drive system in the automatic screw machine illustrated above, for example. The screws originally used to secure the worm wheel to the drum shaft loosened, causing considerable damage, besides loss of production time. These have now been replaced with self-locking UNBRAKO socket head cap screws and the trouble has been eliminated.

An UNBRAKO socket screw with the Nylok self-locking device is a single unit. Just screw it into any tapped hole. Seated or not, it locks positively wherever wrenching stops. Constant vibration or endless running of a machine won't affect these self-locking UNBRAKOS. The screws will not work loose!

Write today for your copy of Form 2193, which gives catalog and technical data on the complete line of UNBRAKO socket screws with the Nylok self-locking device. Or see your local industrial distributor. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN PENNSYLVANIA

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

BLISS HIGH PRODUCTION PRESSES "do-it-themselves" at Black and Decker

Just three Bliss High Production Presses produce the millions of motor laminations Black and Decker uses in its complete line of more than 150 portable power tools!

Running in the upper speed range, sometimes at well above 250 strokes per minute, through two shifts a day—and occasionally three. And they've been doing it for a long time now with no problems.

Of course, H-P presses are built for speed. Extra heavy cast Meehanite frame • *Square* gibbing • Automatic lubrication • Variable speed drive • Special air friction clutch • Counterbalanced crankshaft. Every feature has been especially designed to maintain precision at top speeds. That adds up to top production rates, longer die life.

Another plus, users tell us, is the wide open die area that makes quick set-up and changeover possible. In fact, the fast set-up makes *short-run* work practical with Bliss H-P Presses. And the room *under* the press is a handy place to run chutes or store tote boxes.

If production of short-stroke stamped parts is your problem, long run or short, you'll want to learn more about Bliss H-P presses. Our recently revised 32-page catalog No. 27-C describes the entire line and gives examples of the wide range of work you can accomplish with these presses. Why not write for a copy today.

BLISS SINCE 1857 ®

is more than a name... it's a guarantee

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; Midland and Pittsburgh, Pa.; San Jose, California; *Branch Offices* in Boston, Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, San Jose, Salem, Toledo, Washington, D. C.; and Toronto, Ontario, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. *Other representatives throughout the world.*

E. W. BLISS COMPANY, CANTON, OHIO • Presses, Rolling Mills, Rolls, Special Machinery

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GET MORE OUT OF AIR GAGING

Complete line of Attachments for

IT'S SO EASY to greatly increase the scope of Dimensionair usefulness — and do it economically by using any of the "already designed and built" Attachments. Each Attachment answers three basic requirements.

(1) Easily attached.
(2) Wide range of adjustment.
(3) Performance in keeping with quality of the Dimensionair.

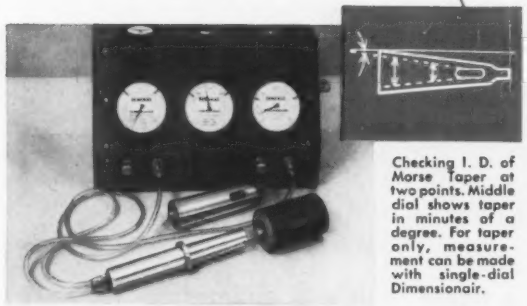
Let us show you how these Attachments will give you more for your air gaging dollar. Write for Catalog 56D or ask our nearest representative to discuss applications in terms of your own needs.

FEDERAL PRODUCTS CORPORATION
7115 Eddy Street • Providence 1, R. I.

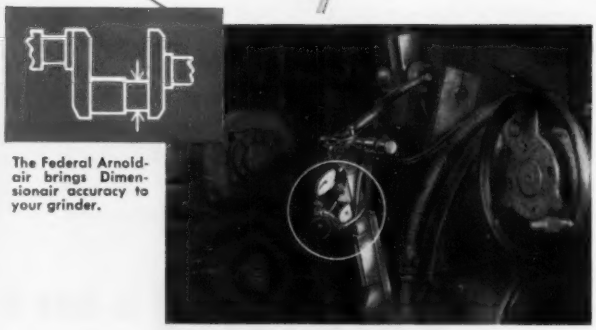
Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for inspecting, measuring, sorting, or automation gaging



Checking I. D. of Morse Taper at two points. Middle dial shows taper in minutes of a degree. For taper only, measurement can be made with single-dial Dimensionair.



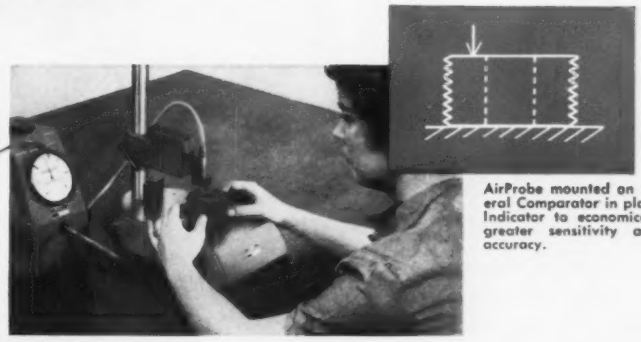
The Federal Arnoldair brings Dimensionair accuracy to your grinder.

SPECIAL ATTACHMENTS AND FIXTURES
When the nature of the work or other conditions necessitate Special Attachments, Federal Engineers with their specialized gaging experience can provide the right design. Whether it's a specially designed Attachment or a modification of a regular design you can be sure it will be the best gaging Attachment for your work.

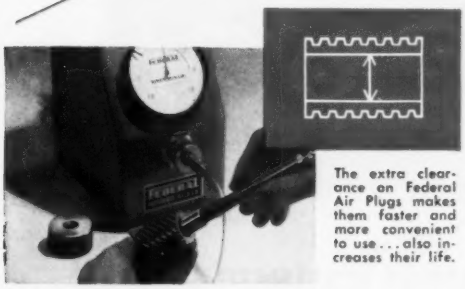
ARNOLDAIR Links the Federal Dimensionair to your Arnold Grinding Gage to provide closer operator control than is possible using a Dial Indicator alone. The Arnoldair response smooths out surface irregularities, allowing the operator to consistently grind pieces within .0001" of nominal. Easily attached to any Arnold Gage. Catalog 55A.

WITH THE DIMENSIONAIR
every measuring need

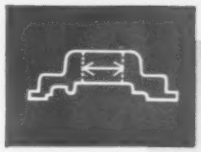
AIRPROBE Small and easily attached to many types of stock model gages. The ideal Attachment where mechanical contact is desired. Its long range per magnification and availability in .003, .006, .0015, and .0030 ranges adapt it for practically any type of gaging, thereby bringing the benefits of air gaging to more unusual types of measurement. The AirProbe is self-zeroing and, in effect, extends the measuring range of the Dimensionair with which it is used. Extremely accurate, the AirProbe is widely used when gaging slight tapers or eccentricity, out-of-roundness, or any similar conditions where a dimension changes gradually.



AirProbe mounted on regular Federal Comparator in place of a Dial Indicator to economically provide greater sensitivity and extreme accuracy.



The extra clearance on Federal Air Plugs makes them faster and more convenient to use . . . also increases their life.

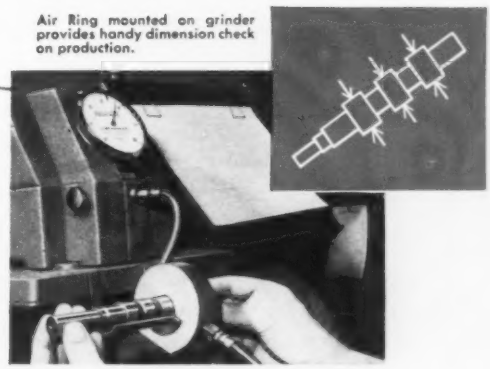


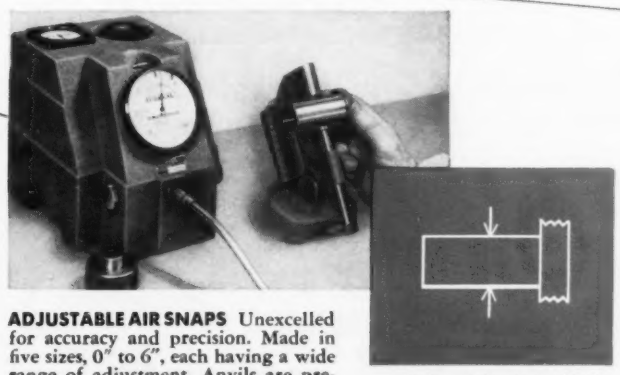
Quickly attached Air Bore Gage checks diameter to .00005" accuracy.

ADJUSTABLE AIR BORE GAGES Light and well balanced, only four gages required to cover all measurements from ½" to 8". Concentricity of centralizing contacts with the measuring contacts is so precise gage can be set with gage blocks or micrometer instead of a special master. Centralization remains accurate even though gage is cocked laterally, and is maintained throughout the capacity of the gage.

AIR PLUGS Furnished in various types . . . Through Hole, Counterbore, and Blind . . . and having one, two, three, four, or six jets as required. Available from .125" diameter, up. The jet faces are set lower in the plug and provide greater protection against damage: air jets are larger and less easily clogged. Plugs are available from stock in many sizes.

Air Ring mounted on grinder provides handy dimension check on production.



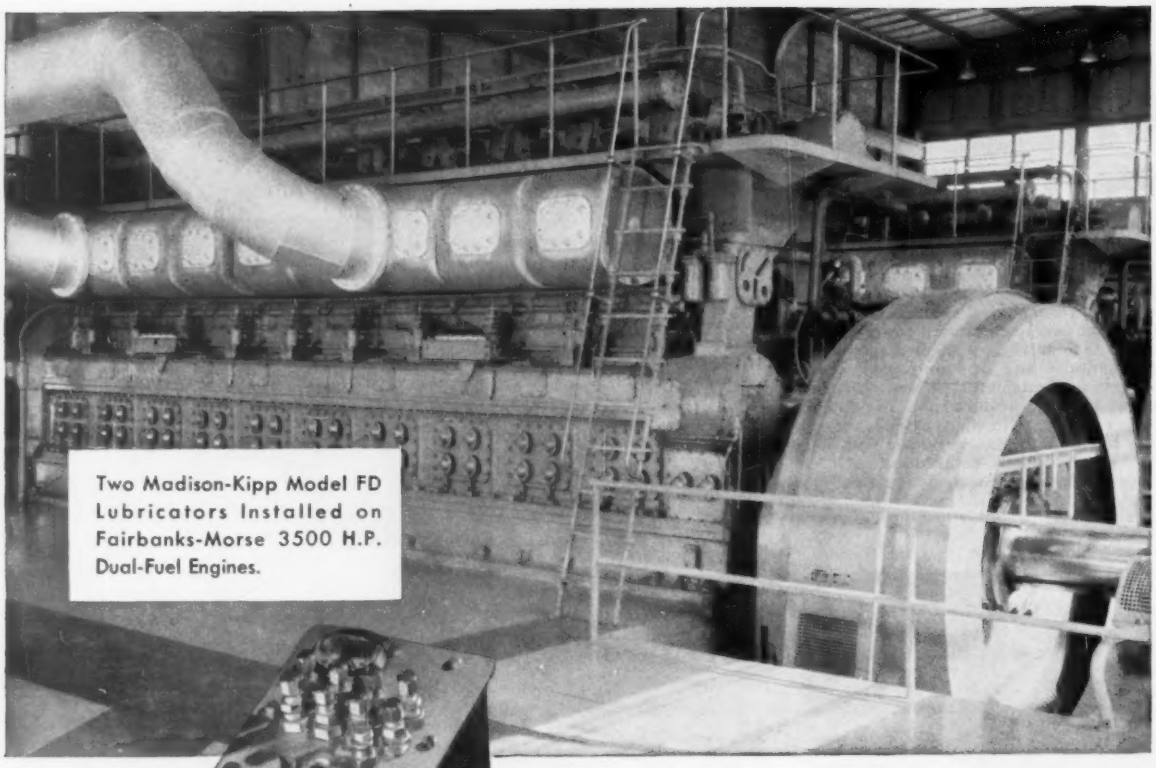


Air Snap in bench stand checks size of drill jig bushing.

ADJUSTABLE AIR SNAPS Unexcelled for accuracy and precision. Made in five sizes, 0" to 6", each having a wide range of adjustment. Anvils are precision lapped, and remain flat and parallel throughout entire range of adjustment. Does not disturb the regular Dimensionair calibration: (.003" at 2500:1 magnification.) Self-zeroing so that only a single master is required for setting to size. Can be used portably or mounted as a bench comparator.

AIR RINGS Regularly furnished with two or three jets. For special applications, can also be furnished with one, four, or six jets. Air jets are larger and recessed farther below the surface than those in competitive makes. This helps eliminate clogging and greatly reduces wear or abrasion. The addition of guide chutes as shown permits parts to be passed through the ring quickly. Rings are regularly available with inside diameters from .250" up to and including 3.010". Larger sizes can be supplied on application.

For more information fill in page number on Inquiry Card, on page 241



Two Madison-Kipp Model FD Lubricators Installed on Fairbanks-Morse 3500 H.P. Dual-Fuel Engines.

Machines of great performance use the most dependable oiling system ever developed

MADISON-KIPP

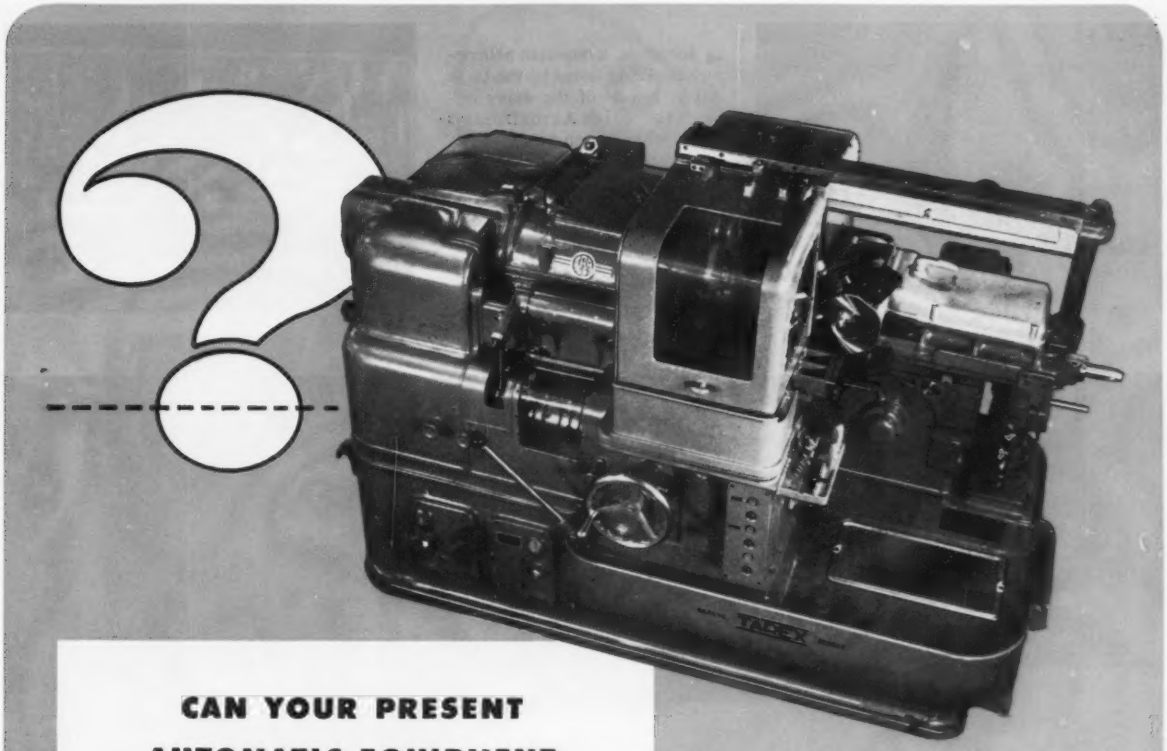
Fresh Oil

...by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy, where oil under pressure fed drop by drop can be installed. There are 6 models to meet almost every installation requirement.

kipp

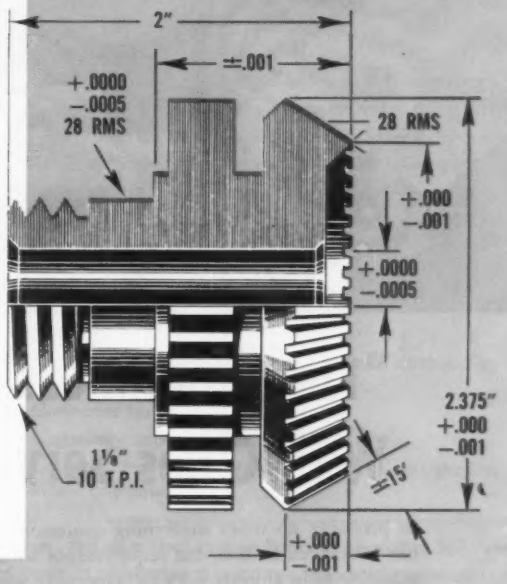
MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WIS., U.S.A.

Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools



CAN YOUR PRESENT AUTOMATIC EQUIPMENT ***make this*** **BEVEL CLUSTER GEAR** ***complete*** **FROM BAR STOCK** ***in one operation*** **READY FOR GEAR CUTTING?** ***...it can be done on the***

TAREX

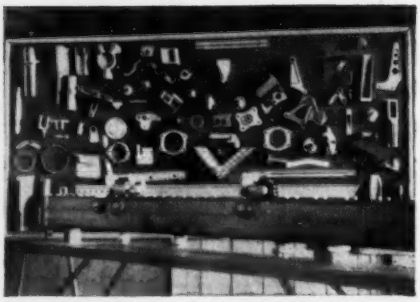


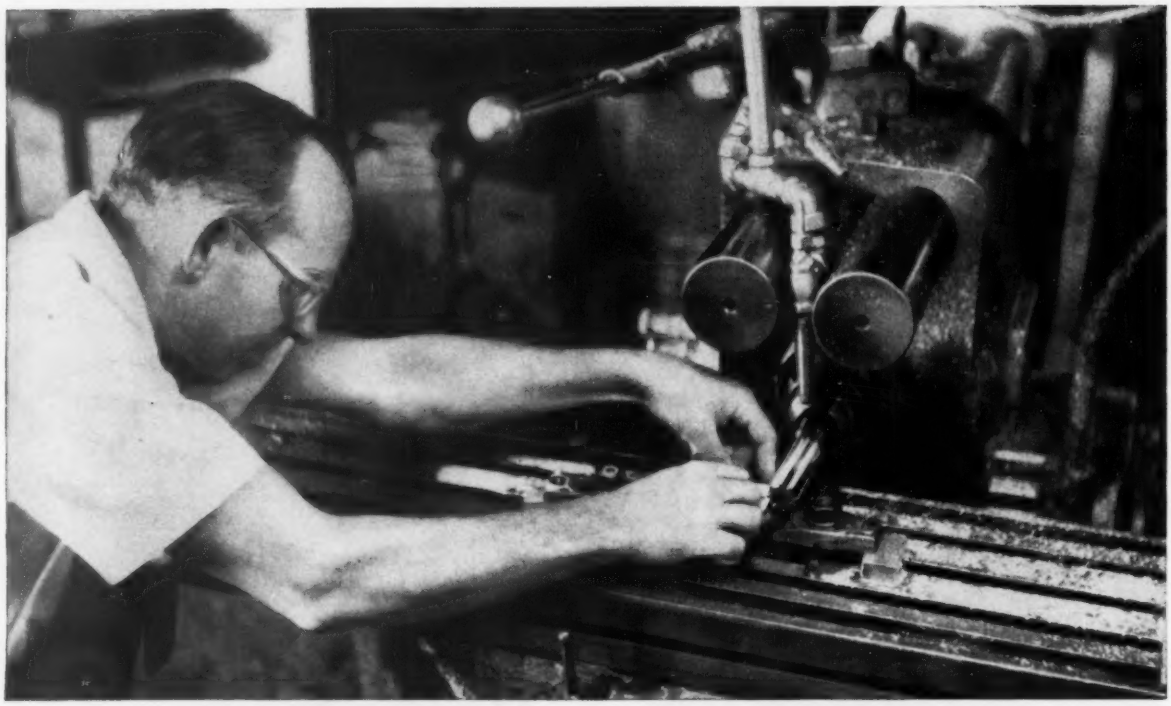
RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

◄ **Aerocycle,** a one-man helicopter now being tested by the U. S. Army, is one of the many aircraft for which Aeroaffiliates machines precision parts.

Some Examples of Aeroaffiliates' Work. ► All require fine tolerances and excellent finish. All were made with the help of Cities Service Chillo Cutting Oils.





"Fine Tolerances! Excellent Tool Life! With Cities Service Chillo Cutting Oil"

In probably no other machining operation are the tolerances so fine, the requirements so demanding as in aircraft work . . . especially when it's for the U. S. Army or Air Force.

But it is on such work that Aeroaffiliates, Inc. of Fort Worth, Texas, has become famous.

Every day, Aeroaffiliates employees must work with tolerances as fine as .0001, and their products must have an unusually good finish . . . so good that they are measured by a special gauge before the aircraft industry will accept them.

Obviously, this could play havoc with tool life . . . "but thanks to Cities Service Chillo Cutting Oils, tool life and finish are the best ever," says Aeroaffiliates. "These cutting oils are equalled only by the help we receive from the Cities Service Lubrication Engineer, a man whose knowledge and help we greatly value."

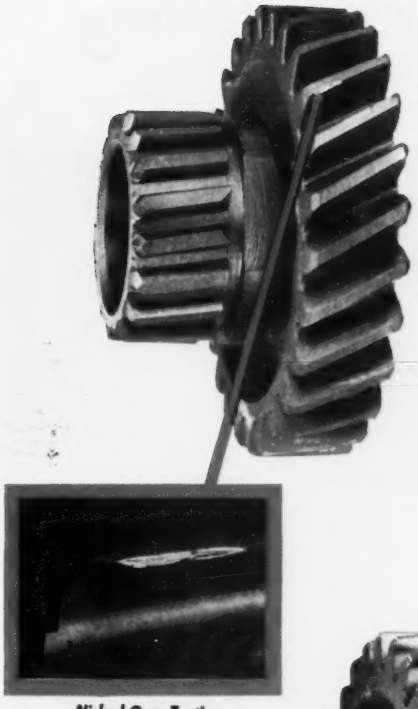
Whatever *your* type of machining operation, there's a Cities Service cutting oil tailored precisely for it . . . and a Cities Service Lubrication Engineer to help you choose it. Call him in this week. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

RED RING HARD GEAR HONING

PRODUCES QUIET GEARS



Nicked Gear Tooth

Same Gear Tooth After Honing

Hard gear tooth honing is an entirely new approach to the vexing problem of intolerable gear noise arising from nicks, burrs, tooth roughness and minor heat-treat distortions.

Honing is not only far more effective than other processes used to combat gear noise but it is also much more economical. And it produces none of the undesirable after effects inherent in other processes such as heat checks, soft skin or residual stresses in the tooth metal.

Gear honing does four important things:

- Smooths off the swaged or raised metal surrounding tooth nicks.
- Eliminates burrs.
- Materially improves surface finish.
- Corrects minor heat-treat distortions in profile, index and lead.

When used as a final routine finishing operation following heat-treat, it eliminates the tedious and costly operation of searching for nicks and then correcting them. It improves the quality, uniformity and performance of all gears produced.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

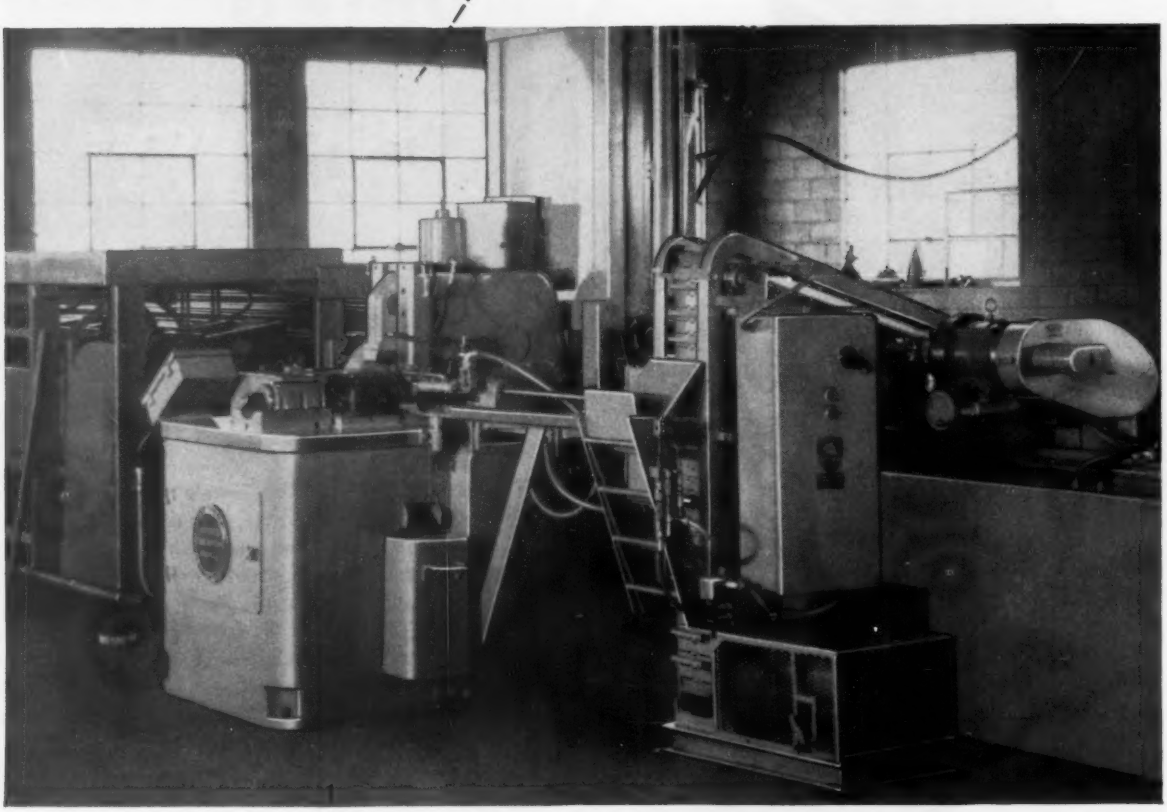
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Patents pending

7631

One Grieder Tube Cut-off Machine Is Producing...

2400 Crankcase Filler Tubes Per Hour For A Major Automobile Manufacturer



Tube Specifications

Mechanically welded 1⅜" OD, .035" wall thickness, mild steel supplied in 22' lengths. Cut off in lengths of 9.070" plus or minus .002" with both ends finished burr free.

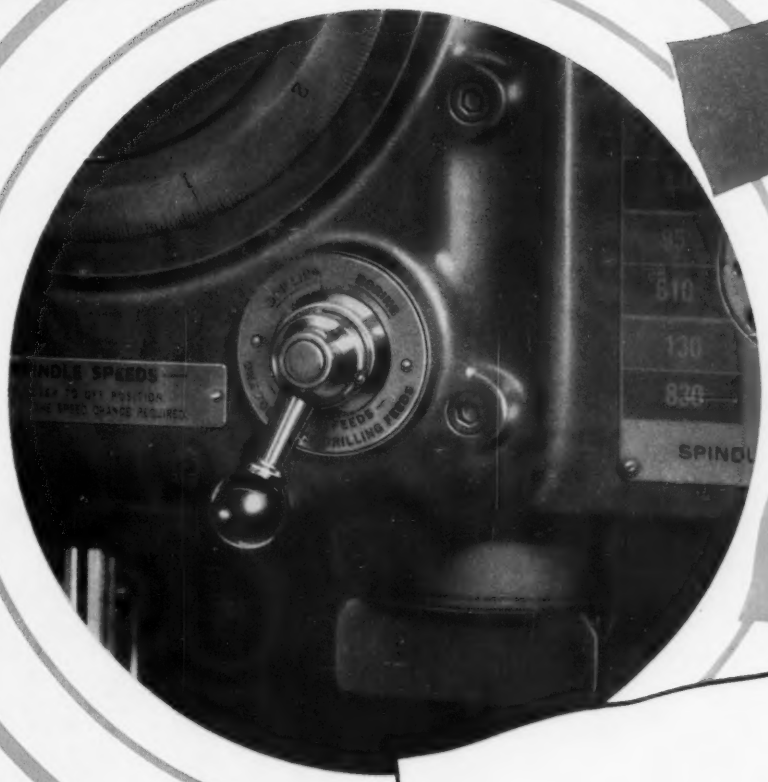
The Grieder Tube Cut-off Machine cycling at the low end of its 4500 to 6000 pieces per hour rate runs intermittently. Production on this application is limited by the cycling rate of the special end finishing machine to which it is coupled. This complete line of machinery is electrically interlocked for automatic operation.

Grieder Tube Cut-off Machines are made in three sizes to accommodate tubes of any shape from 3/16" to 4" OD. Hoppers for automatic feeding of tubes are available as extra equipment. Write for literature.

GRIEDER INDUSTRIES, INC.

P. O. BOX 169, BOWLING GREEN, OHIO

For more information fill in page number on Inquiry Card, on page 241



Again...

"AMERICAN" expands the scope of Radial Drill usefulness

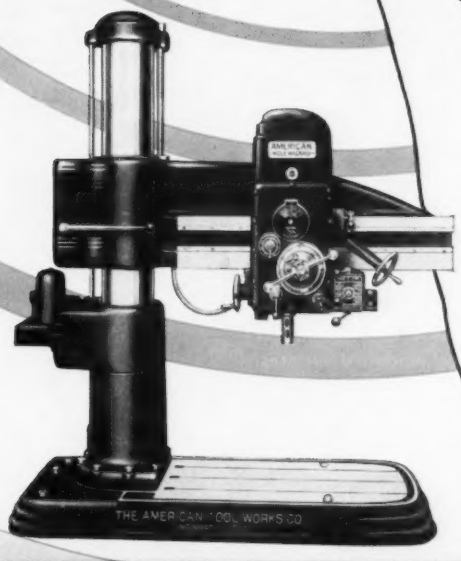
9 inch and 11 inch column "AMERICAN" HOLE Wizard Radials now may be equipped with a FINE FEED BORING ATTACHMENT.

This attachment furnished in addition to the standard feeding mechanism, merely by the flip of a lever reduces the standard feed range 75%.

The fine boring feeds thus provided are the answer to precision boring on radial drills. Many tool and die shops are already using them for high precision, fine finish boring of jigs and fixtures.

Another *first* of great value to help radial drill users to produce more and better work at less cost.

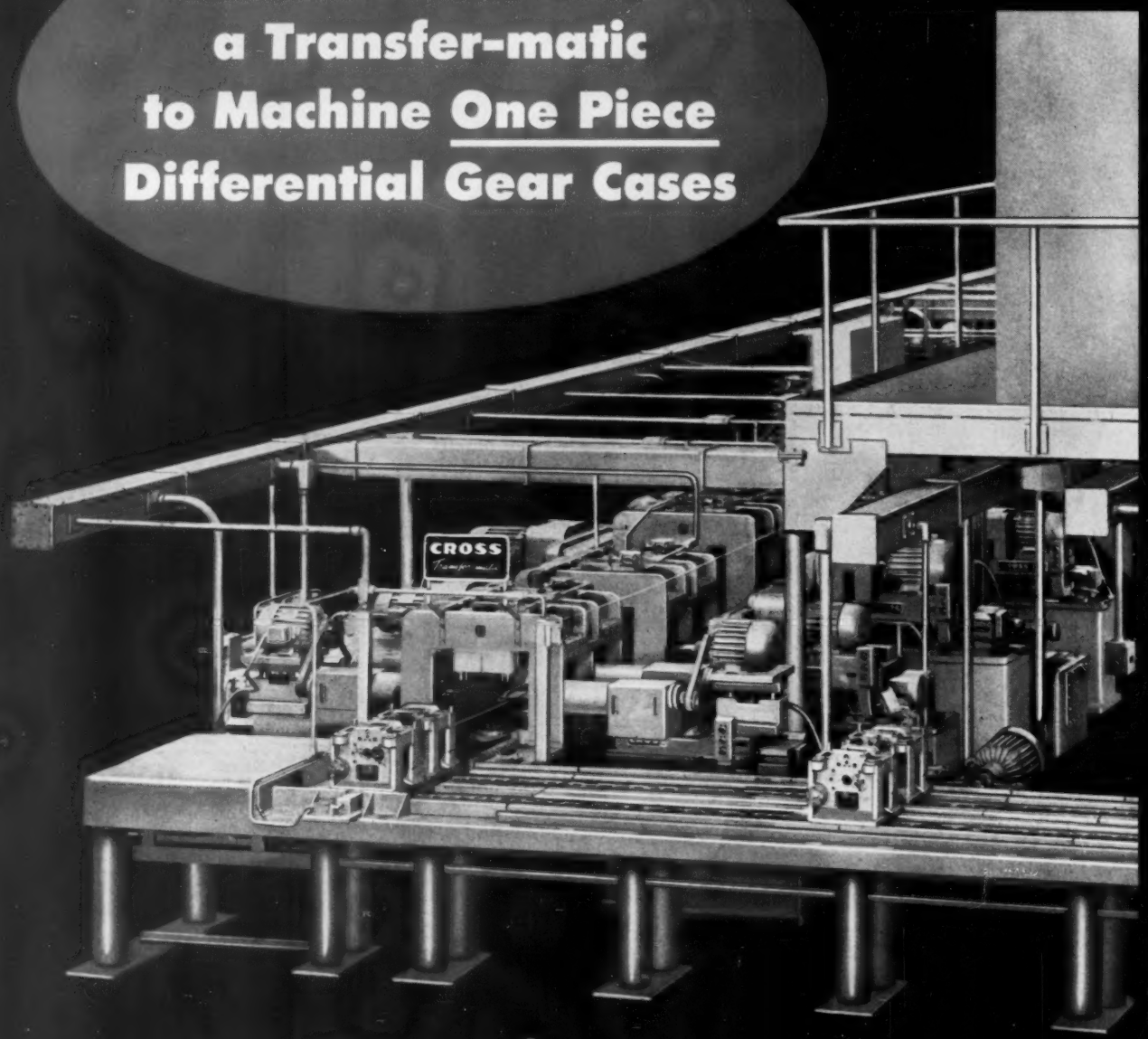
Bulletin No. 325 tells the story.



THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

Another Cross First – a Transfer-matic to Machine One Piece Differential Gear Cases



Cutaway view of differential gear case showing machined surfaces.

Established 1898

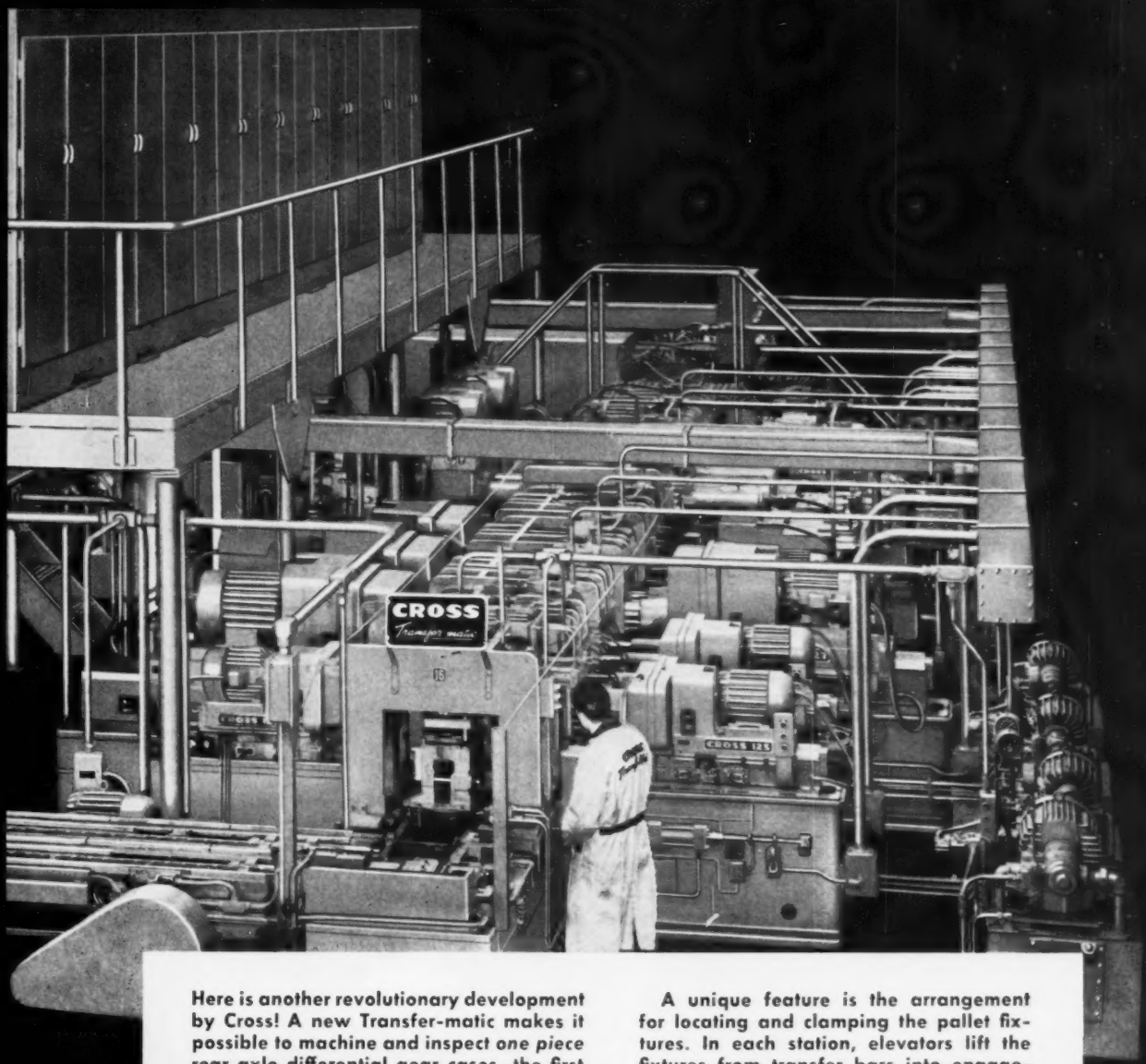
THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

HILL double housing

Another Transfer-matic by Cross

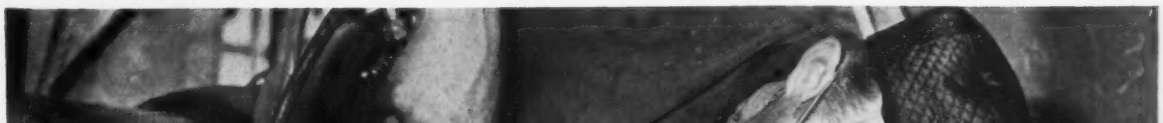


Here is another revolutionary development by Cross! A new Transfer-matic makes it possible to machine and inspect *one piece* rear axle differential gear cases—the first time such a part has been processed on a transfer machine.

Two cases are machined at a time as they travel a distance of 206 feet through 30 stations. Rated capacity is 212 pieces per hour at 100% efficiency. Operations include rough and finish forming the two spherical seats for the pinions; rough and finish boring and facing the two seats for the side gears; drilling, boring and reaming the pinion shaft hole; drilling and reaming the lock pin hole; drilling, chamfering, spotfacing and reaming the twelve ring gear mounting holes.

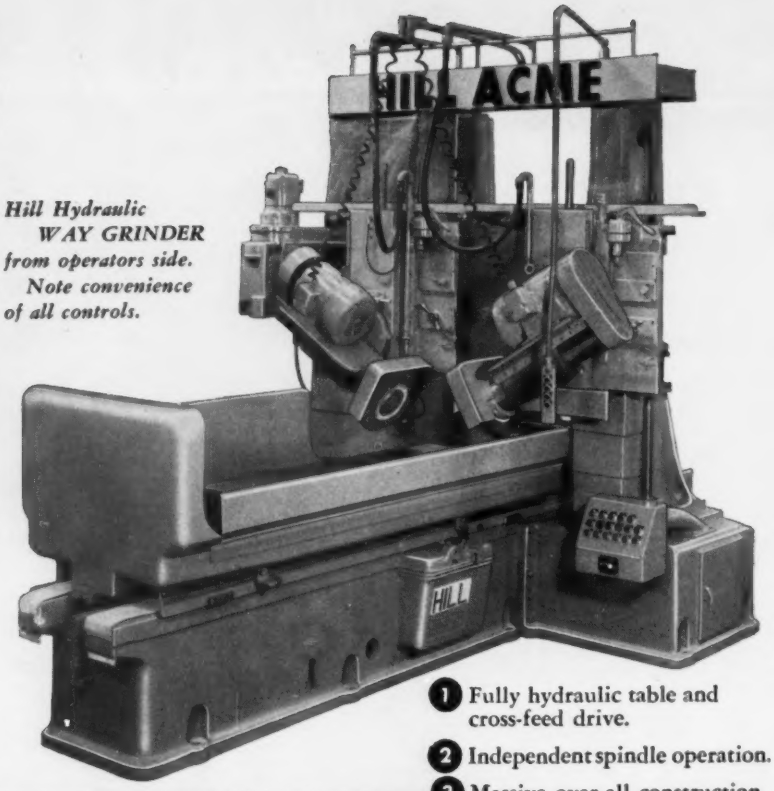
A unique feature is the arrangement for locating and clamping the pallet fixtures. In each station, elevators lift the fixtures from transfer bars into engagement with locating pins and stop buttons fixed in the overhead bridge structures. Individual wedges then back up the elevators to secure the pallets. After cutting, the elevators lower the pallets onto the transfer bars, which carry them to the next station.

Other features include construction to JIC Standards, hardened and ground ways, complete interchangeability of all standard and special parts, pre-set cutting tools and Cross Machine Control Units which program tool changes to reduce machine downtime.



HILL double housing WAY GRINDER for accurate grinding of V's, Flats and Angles

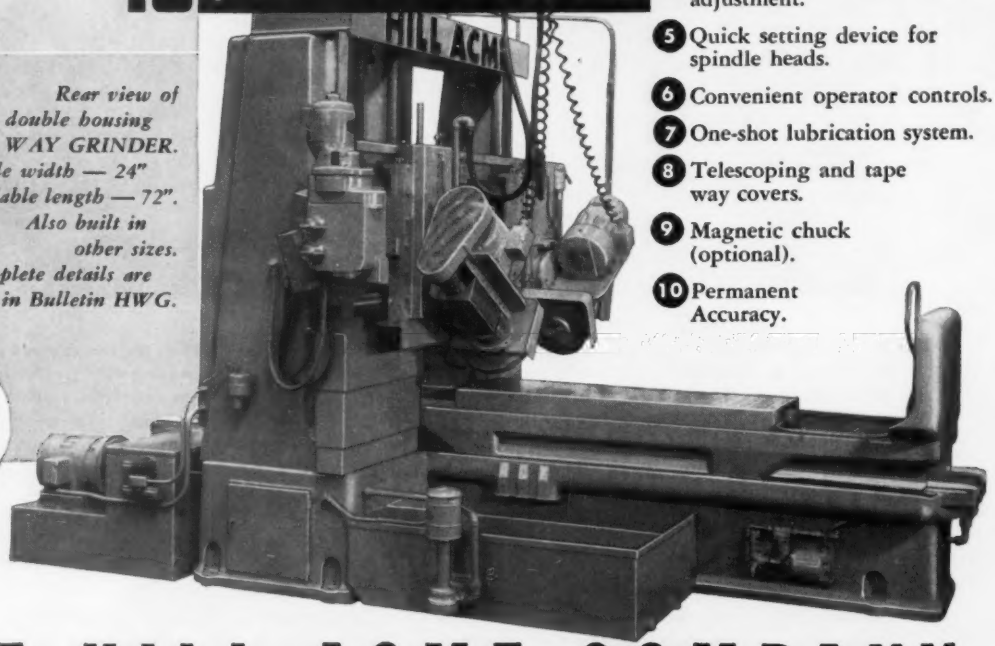
Substantial Savings (up to 50%) over previous methods.



Hill Hydraulic WAY GRINDER from operators side. Note convenience of all controls.

10 points worth considering

1. Fully hydraulic table and cross-feed drive.
2. Independent spindle operation.
3. Massive over-all construction.
4. Rapid traverse and fine feed adjustment.
5. Quick setting device for spindle heads.
6. Convenient operator controls.
7. One-shot lubrication system.
8. Telescoping and tape way covers.
9. Magnetic chuck (optional).
10. Permanent Accuracy.



Rear view of HILL double housing WAY GRINDER. Table width — 24" Table length — 72". Also built in other sizes. Complete details are given in Bulletin HWG.

HILL ACME TOOLS FOR INDUSTRY

THE HILL ACME COMPANY

1209 WEST 65th STREET • • • CLEVELAND 2, OHIO

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING THREADING • TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES

VICTOR TORCH with cutting tip of Anaconda Tellurium Copper, which has the resistance to heat and wear required to maintain uniform flame characteristics through a long life of service.

Tellurium Copper makes better cutting and welding tips

Two typical Victor torch tips of Anaconda Tellurium Copper-127 shown full size.

THE PROBLEM: Victor Equipment Company of San Francisco first used regular leaded copper rod in making tips for its line of cutting and welding torches. In some applications, however, the leaded copper did not stand up under high heat conditions.

THE SOLUTION: Victor tried Anaconda Tellurium Copper-127 Rod and found the answer. The Tellurium Copper had a much higher heat resistance. This meant long, trouble-free service for its precision-made cutting and welding torches in all types of applications. At the same time, the Tellurium Copper provided uniform machinability, especially important in drilling the deep holes prior to completion by swaging on mandrels.

FREE TECHNICAL SERVICE: No matter what your special problem may be, The American Brass Company can very likely furnish free-cutting copper and copper-alloy rod to meet the requirements of the product or the operation.

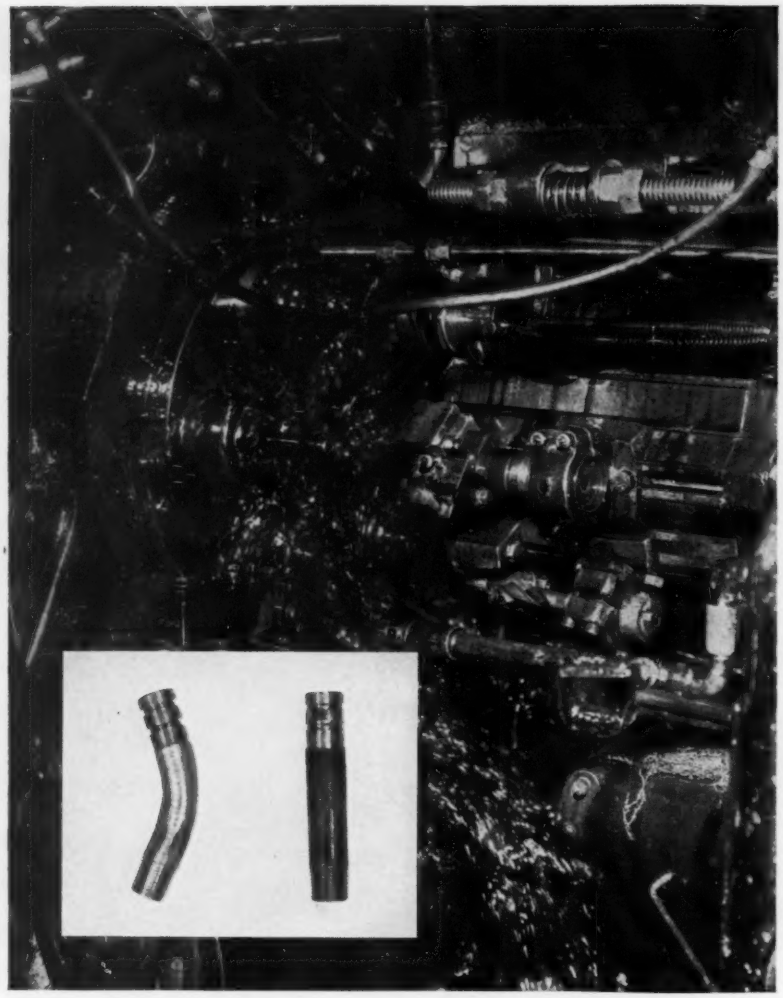
It is the function of the Technical Department of The American Brass Company to assist metal users in the selection of Anaconda Rod. This service is at your disposal without charge or obligation. Comprehensive data on composition and machinability of standard Anaconda Rod Alloys, together with specification references, weights and dimensions, are available in Publication B-3. For this booklet – or technical assistance – write: The American Brass Company, Waterbury 20, Conn. 5765

ANACONDA® COPPER and COPPER ALLOYS

MADE BY THE AMERICAN BRASS COMPANY

"We get better finish and die threads last longer

...with Texaco Sultex Cutting Oils," says Cormier & Shaver Mfg. Co., Cleveland, Ohio



Machining carbon steel parts on New Britain multiple spindle automatics.

"We are a job shop," continues this customer, "and we machine many different types of steel. But our most demanding operation is the threading of automobile car heater parts from SAE 1010 carbon steel. We need a cutting oil that will provide a fine finish, and that will give us good die thread life. For several years now, *Texaco Sultex Cutting Oil A 2* has been doing an outstanding job for us."

There is a complete series of *Texaco Cutting Oils* to handle your toughest jobs in high speed cutting, broaching, threading and tapping. Let your Texaco Lubrication Engineer suggest the proper ones to help you do all your machining most efficiently, and at lowest cost. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

For more information fill in page number on Inquiry Card, on page 241

- Industry Spending Up—Ceiling Near
- Government Spending Down? Apparently Not
- Mobilization Policy Change
- Washington Briefs

Keeping up with Washington

By Loring F. Overman

LATEST survey of industrial expansion plans, released by the Department of Commerce and the Securities and Exchange Commission, indicates important gains in capital spending for 1957.

Dollarwise, total investment in plant and equipment will be up 6 per cent over 1956 to a total of 37.4 billion dollars. In physical volume, the total will show an increase of less than 6 per cent—rising prices of construction and machinery being held responsible.

New Commerce and SEC figures give the business outlook somewhat of a shot in the arm. There had been rumors of curtailed plans and cancelled orders. Newest estimates indicate that the bad news was exaggerated, but observers concede the trend is not strongly upward.

A Principal Cause of continued industrial expansion is technological progress. Rapid strides in automation, electronic computation, and other mechanical evolution are hastening the replacement of equipment which might otherwise be considered "good enough for some time to come."

Projected Expenditures for plant and equipment in durable goods industries are to reach 8.49 billion dollars —up from 7.62 billion dollars in 1956. Of this total, machinery (except electrical) anticipates 1.39 billion dollars, compared with 1.07 billion dollars in 1956. Electrical machinery and equipment forecasts 692 million dollars—up from last year's 603 million dollars. Public utilities plan the largest increase, up from 4.89 billion dollars in 1956 to 6.06 billion dollars this year.

Washington Observers, while foreseeing that total expenditures for capital improvement may be reaching a plateau, are confident that present levels will continue.

Government Spending—Up or Down?

How to prune the Administration's 71.8-billion-dollar budget for fiscal 1958 was one of the hotter topics as Congress got down to business. United States Chamber of Commerce opined that 5 billion dollars could be trimmed without handicapping government services or defense programs. In a special briefing session for economizers, the Chamber pointed out that even defense programs should no longer be considered "sacred cow."

On Capitol Hill, House Appropriations Committee Chairman Clarence Gannon (D-Mo.) predicted Congress can and will cut 4 billion dollars from the 1958 requests. Conversely, House Speaker Sam Rayburn observed: "Can't be done. Government is big; will stay big. Taxes are high; will stay high. Whether expenses will ever be cut, I hesitate to say."

Members of Congress sum it up this way:

"Never have I seen so much mail urging budget cuts."

"Yes, but—for every letter urging a cut, there are five letters demanding that I support some pet project in which one or more of my constituents are interested."

Letters from home being what they are to a Congressman, Washington is calling the bets at five to one against any marked decrease in Government spending.

How Congress really feels about making money available for Government use is revealed by the quick extension of Korean "emergency tax rates" beyond the April 1 deadline. Extension also "saves" (for use by government) nearly a billion dollars in excise taxes which had been slated to expire on April 1. Corporate income taxes were scheduled to drop to 47 per cent from 52 per cent. Tax revenue represented by the 5 per cent difference in rate totals nearly 3 billion dollars.

Mobilization Policy Change

Defense Mobilization Order VII-7 points a new course for mobilization policy. The new order indicates that the Pentagon now thinks in terms of a quick, violent war in the case of nuclear attack. The earlier mobilization directive had presumed that, as in World War II, there would be time for a build-up of weapons. Meanwhile, the Air Force has adopted the premise that only limited amount of production would be possible following an attack.

Plants selected for production under attack conditions are to be fully equipped with production lines and must be ready to roll on "must" items. Plans anticipate that an attack would launch the approved program on an overtime basis, utilizing internal sources of power if necessary, and without the benefit of long distance communication in the event of disruption of such services. Some preparation must also be made for supplying a "smaller war" under less violent conditions—a fact held responsible for the rapidly climbing cost of defense.

Washington Briefs

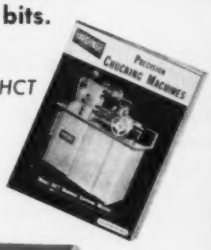
- The government's new Federal Catalogue system is to be completed by 1961, the House Appropriations Subcommittee has been told by the General Services Administration. Catalogue is to have 900,000 items.
- Increasing use of nuclear power plants, rockets, and ramjet engines will create new problems for industry, Assistant Air Secretary Dudley C. Sharp, Materiel Branch, has pointed out. "The sizes, shapes, and tolerances required will demand increased automation and numerical control over machine operations," he said. "We will have to use, particularly in small machines, more and more automatically controlled operations of great flexibility and accuracy, programmed through mathematical analysis of engineering data."

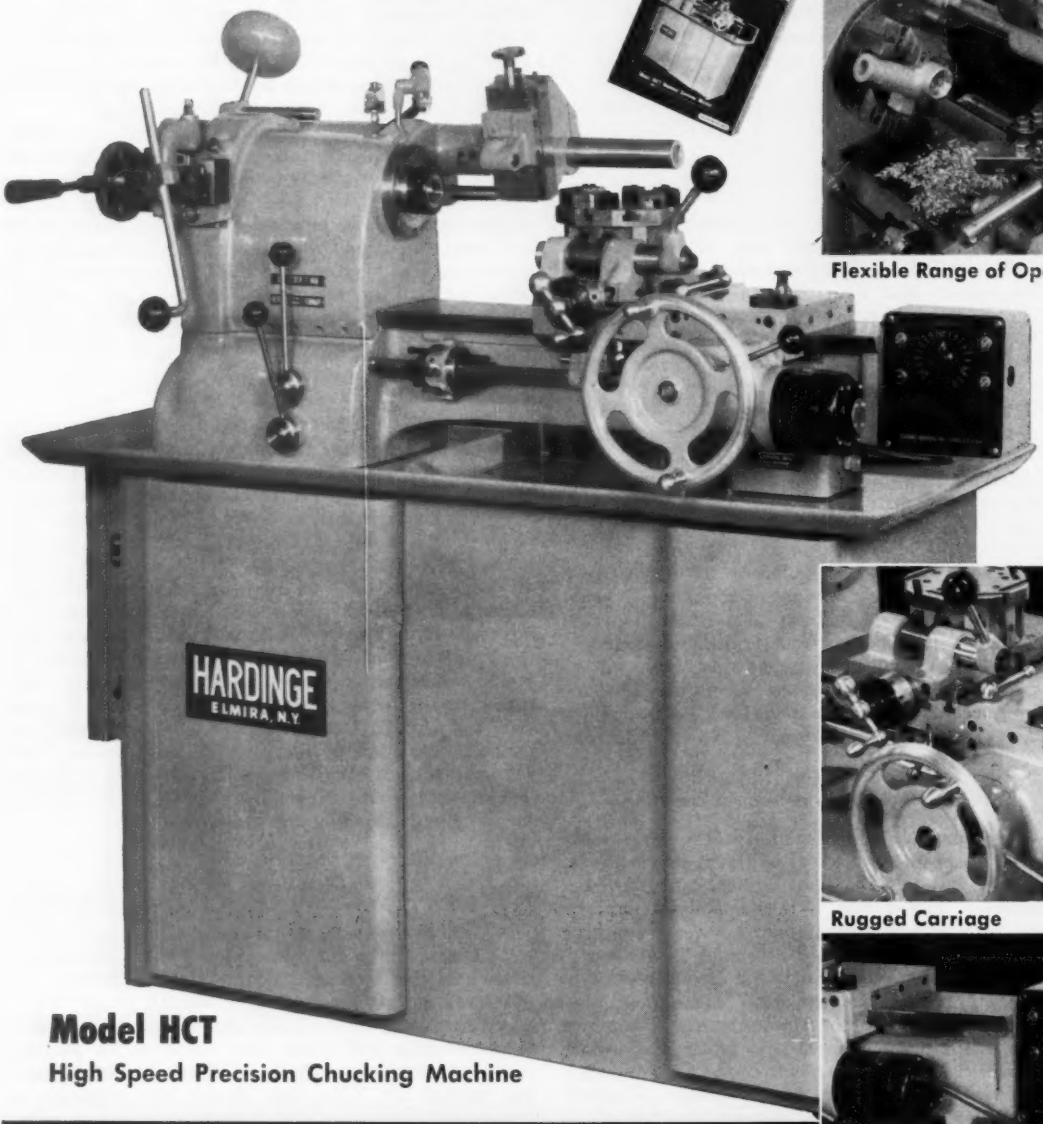
HARDINGE
ELMIRA, N.Y.

PRODUCTION
With Tool Room Accuracy

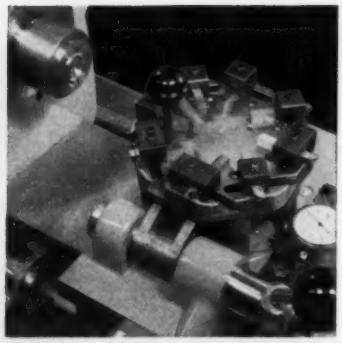
Hardinge Precision Chucking Machine HCT finish diameters, recesses, shoulders, back faces, front faces, and cuts precision threads in *one setting — all concentric* with each other. Tooled inexpensively with standard tool bits.

For complete information write for Bulletin HCT

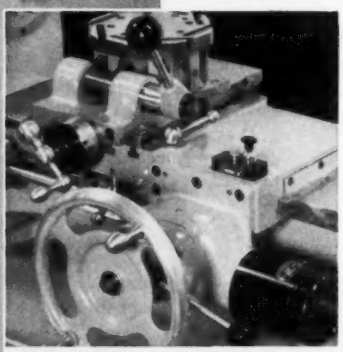


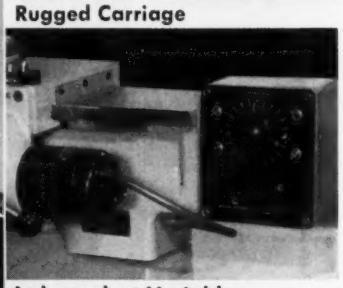


Model HCT
High Speed Precision Chucking Machine


8-Station Turret

Flexible Range of Operation


Rugged Carriage


Independent Variable Carriage Feed

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette Street, New York 12, N. Y.

For more information fill in page number on Inquiry Card, on page 241

Machinery
MAY 1957

Articulate Engineers In Big Demand

IT is common knowledge that engineers, no matter how expert in their special branches of science, are rarely capable of expressing themselves clearly, either orally or on paper, when it comes to discussing matters within their particular realm. They can get their ideas across to fellow engineers, but in expounding thoughts to people who are not trained along the same lines, they often become as inarticulate as the young Demosthenes is said to have been.

In these days, there is a great demand for specialized technical writers—men who can prepare reports, operating manuals, articles for the technical press, and books on engineering and scientific subjects.

For example, the International Business Machines Corporation builds electronic computers for the SAGE radar system. Manuals had to be written that explain the operation and maintenance of these computers. To prepare the 20,000 pages of these manuals required the time of seventy-five technical writers for nine months.

Practically every machine tool builder is faced with the necessity of providing operating manuals for his equipment. Automobile manufacturers must supply instruction booklets for service garages and car buyers. Repairmen of television and radio sets and of a large variety of household appliances must have technical brochures at hand for ready reference. The demand for such literature is indeed great.

Men with sufficient technical education and adequate writing ability for work of this category are hard to find. It is generally necessary to train graduate engineers for this specialized activity after they have left college. Graduates from schools of journalism are unsuited for the work because they do not have an engineering background. No one can do a good job writing about things with which he is unfamiliar.

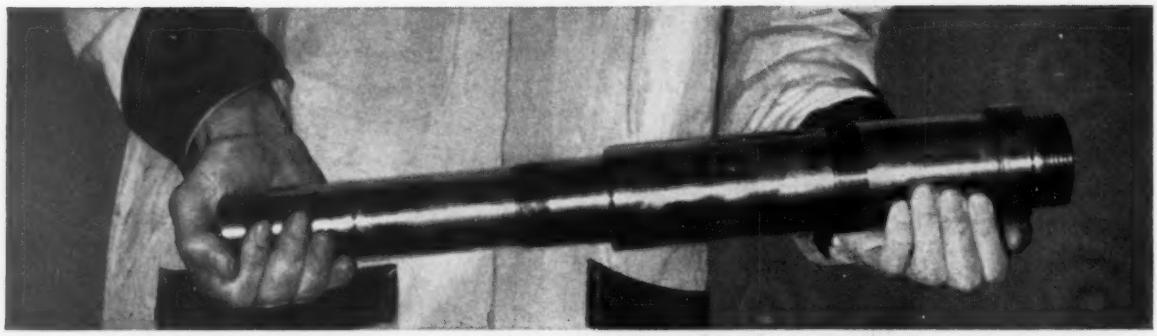
Several technical colleges have recognized this need of modern industry and offer full scholastic programs that turn out engineers with developed writing ability. But the need is so great as to demand the attention of more educational institutions.

The financial rewards of technical writers could well be stressed to college students. A recent survey has shown that salaries of men trained in writing engineering and scientific literature average approximately 80 per cent more than the median salary of mathematicians, biologists, physicists, and other scientists. No one should choose his vocation on the basis of remuneration alone, but there can be no quarrel with anyone who selects work that brings him personal satisfaction and, at the same time, a good salary.

Charles O. Herb

EDITOR

Machining Costs Cut 25%
by switch to NEW RYCUT 50

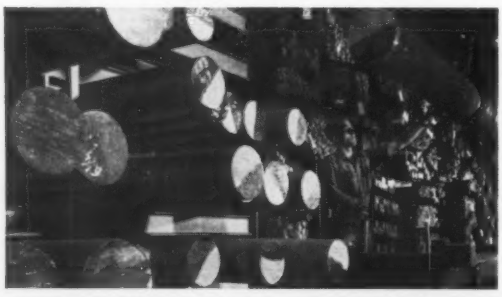


Logan Engineering Co. report shows how you can save up to 30% with a Ryerson leaded alloy

THE PROBLEM—This Chicago manufacturer of precision lathes faced a tough production problem from a time and cost standpoint. Lathe spindles have to be tough and hard with high wear resistance—so the steel Logan originally used was SAE 52100.

But the spindles were turned down and center-drilled from the solid to hole sizes as large as 1⅜". And ID's had to be accurate and free from scoring along the entire length of the spindles. 52100 provided the required mechanical properties but was slow cutting and created production difficulties and a high scrap rate.

Needed: A *free-machining* steel that would develop the high hardness levels, the toughness and wear strength required for the application.



THESE LARGE ALLOY STOCKS . . . also carbon and stainless steels in every shape and size, are in stock at Ryerson. Also call Ryerson for reinforcing steel service, industrial plastics, machinery and tools, etc.

THE SOLUTION—Logan engineers had long been on the lookout for a steel that would solve their production problems so they were eager to try New Rycut 50 when this Ryerson 50-carbon alloy steel with a controlled lead addition was suggested by Ryerson metallurgists.

New Rycut 50 was a success from the start! Now, after two years, Harry Peterson, Logan plant superintendent, reports: "New Rycut 50 has saved us a consistent 25% of our former costs in the production of lathe spindles. Rycut's uniform machining and hardening properties have reduced scrapped parts to a minimum and the steel has proved satisfactory in every way."

This is just one of many case histories in our files on the steels in the Rycut series—New Rycut 50, Rycut 40 and Rycut 20. Actual performance records show machinability increased as much as 50% . . . tool life lengthened as much as 300% when a Rycut steel is used in place of a standard alloy of comparable mechanical properties.

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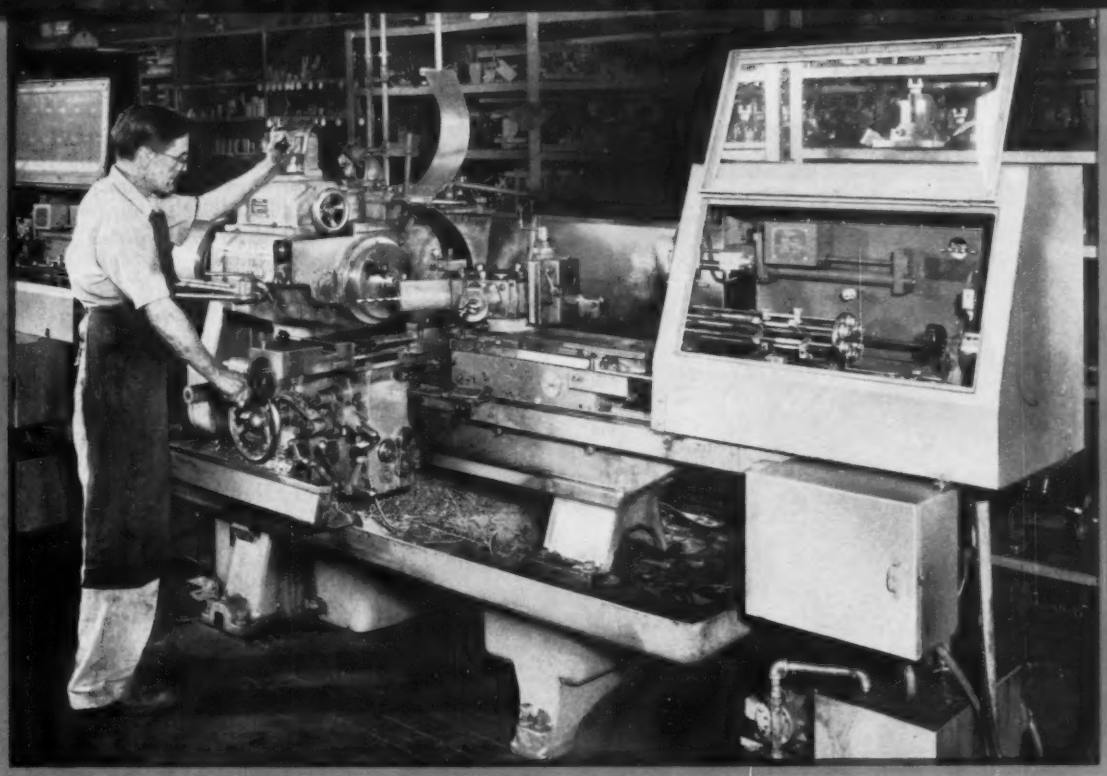


Hydraulic Drive Attachment Automates Turret Lathes

Automatic cycling of ram type turret lathes is made possible by a hydraulic drive unit that can be used to index the turret, feed the cross-slide, change the spindle speed, advance bar stock, reverse the direction of spindle rotation for tapping operations, and open and close the collet

By JULIUS A. FENDER, Process Engineer
Detroit Diesel Engine Division
General Motors Corporation
Detroit, Mich.

STANDARD ram type turret lathes are widely used to produce small to medium quantities of various parts at minimum cost. Such machines can be tooled easily and economically. However, one objection has been the need for manual performance of so many functions. This problem has been solved at the Detroit Diesel Engine Division of General Motors Corporation by equipping many of the turret lathes with hydraulic drive units which automatically feed and index the hexagon turret.

The hydraulic attachment, made by the Lynn Mfg. Co., Minneapolis, Minn., is mounted on the right-hand end of the turret lathe bed, as seen in the heading illustration. An electric-motor-driven pump having a capacity of 5 gallons per minute is located on the floor below the unit. With the maximum pump setting of 1500 pounds per

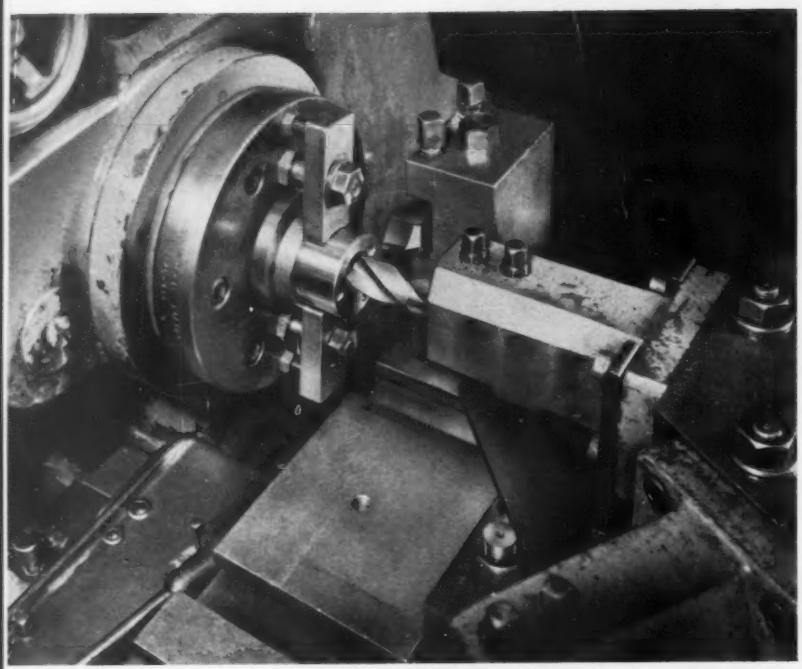


Fig. 1. Close-up view of turret lathe seen in the heading illustration shows cam and roll follower employed to automatically feed cross-slide.

square inch, a thrust of 4300 pounds is developed.

Essentially, the hydraulic drive unit consists of directional control solenoids, dwell timing cylinders, the necessary valves, and a reel assembly having six hexagonal stop-bars. Each stop-bar is equipped with a rapid traverse dog, a stop-dog, and a micrometer-screw nut and dial. With each turret face in cutting position, the turret is rapidly fed forward until a rapid traverse dog contacts a lever which actuates a micro switch. This energizes a solenoid which strikes a lever to slow the turret advance to the pre-set feed rate. The same automatic cycle is repeated to reverse the turret and return it at rapid traverse.

The micrometer-screw dials are graduated in increments of 0.005 inch for accurately setting the stop-dogs for a part tolerance of 0.002 inch. Rapid traverse forward is at the rate of 22 feet per minute, and return, 26 feet per minute. The feed rate for any turret station can be varied from 0.3 inch to 220 inches per minute. Total stroke is 15 inches, and dwell time at the end of the forward stroke is infinitely adjustable from a minimum of 0.2 second.

The automatic cycling can be stopped at any turret station. This is particularly desirable for some chucking operations. For bar work, the automatic cycle is continued until the entire bar has been used. Threading operations are performed by means of a

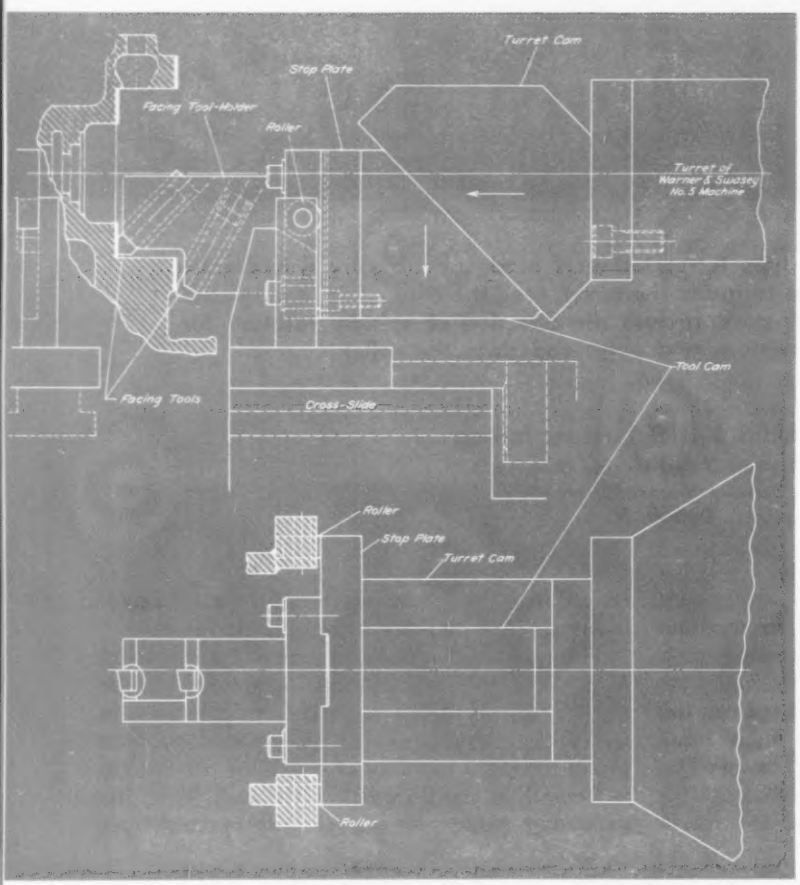


Fig. 2. Two facing operations are performed by means of this cam arrangement. Rollers stop the advance of the tool cam as the turret is fed toward work.

low-pressure tapping circuit which handles either releasing type or solid taps, as well as chasers. The spindle can be automatically reversed at the end of the forward stroke when using solid taps.

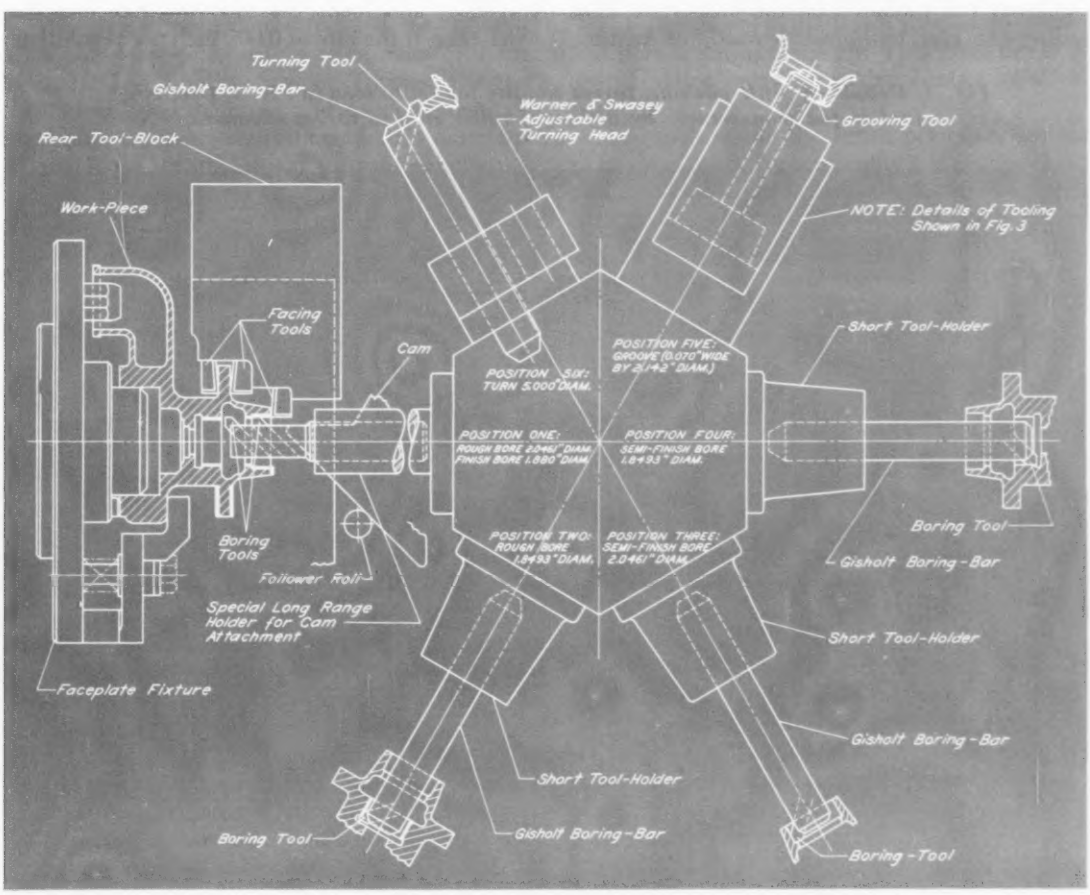
Spindle speeds can be changed automatically, the number of changes depending on the make of turret lathe. Also, the turret can be reciprocated to clear chips during accurate deep-hole drilling. Other automatic features include collet opening and closing, bar stock feeding, and back-feed of the turret tools at any desired station.

While it is better to perform as many operations as possible—particularly those requiring heavy stock removal—with tools mounted on the various turret faces, the cross-slide can be fed automatically in either direction with the hydraulic drive unit. This is accomplished by means of a cam and roll follower, as seen in Fig. 1. Any portion of the travel can be performed in rapid traverse, and the direction of cross-slide travel can be reversed by using the back-feed control. Upon completion of the operation, the cross-slide returns to its starting position.

One of the many parts produced at Detroit Diesel on turret lathes equipped with hydraulic control units is the cast-iron water pump body. These complex, cored castings have a maximum diameter of about 9 3/4 inches, and are 6 3/4 inches long. The large-diameter body of the pump body is machined on a Warner & Swasey No. 5 turret lathe that is equipped with a Lynn hydraulic drive attachment. On this machine the work is clamped in a three-jaw chuck and rotated at 224 R.P.M. while boring and facing various surfaces.

Details of the tooling employed at the second position on the turret, Fig. 2, illustrate a method of cam-actuated feeding of the tools in a transverse direction. In this setup, a stop-plate is bolted to the front of the tool cam, and the facing tool-holder is secured to the stop-plate. Two rollers are mounted on fabricated pedestals projecting vertically from the turret lathe cross-slide.

Fig. 3. Tool layout for a No. 4 turret lathe used to face, bore, groove, and turn cast-iron water pump bodies in an automatic cycle.



When the turret is hydraulically fed toward the work, the stop-plate comes in contact with the rollers. Continued advance of the turret forces the tool cam downward, the angular face of this cam sliding against the mating surface of the turret cam. This feeds the two tools at the rate of 0.002 inch per revolution to face the bottom of the impeller pocket and the joint surface of the casting simultaneously.

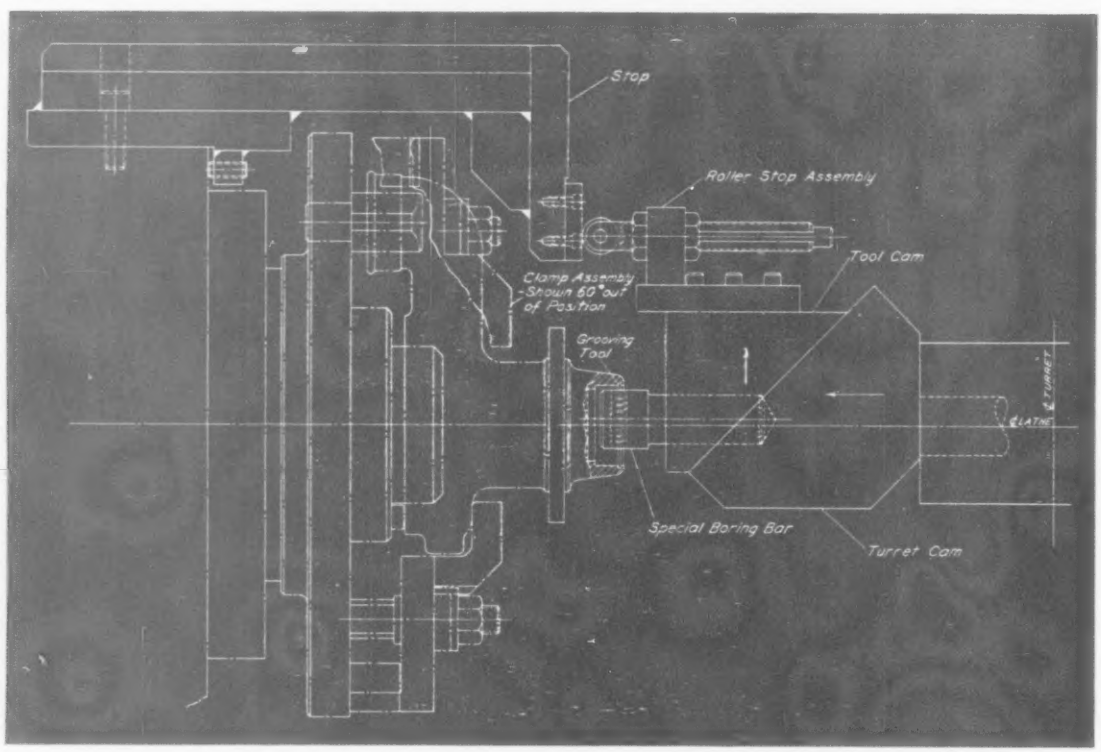
The tool layout employed on a Warner & Swasey No. 4 turret lathe (also equipped with a Lynn attachment) for facing, boring, grooving, and turning the small-diameter ends of the bodies is shown schematically in Fig. 3. The casting is located over pins and a center plug on a special face-plate fixture, and manually clamped by means of spring-loaded fingers.

In this application, the cross-slide of the turret lathe is used for three facing operations. The rear tool-block carries one tool for facing the small-diameter end of the water pump body, and two tools for facing both the front and rear surfaces of the flange. These tools are automatically fed transversely at the rate of 0.013 inch per revolution by means of a cam attached to the first-position face of the hexagonal turret. As the turret advances toward the work, the cam contacts a follower roll mounted on the cross-slide, thus feeding the rear tool-block toward the casting. Simultaneously, one internal surface having a diameter of 2.0461 inches is being rough-bored and another with a diameter of 1.880 inches is being finish-bored by two tools held in a bar on position one of the turret.

Another internal surface, 1.8493 inches in diameter, is rough- and semifinish-bored by tools mounted at positions two and four on the turret. The surface rough-bored at the first position is semifinished at position three. All three of these boring tools are fed at the rate of 0.011 inch per revolution. An internal groove, 0.070 inch wide by 2.142 inches in diameter, is cut into one of the casting bores when position five on the turret has been automatically indexed into the machining location.

Details of the tooling employed at the fifth position on the turret are shown in Fig. 4. Here a two-element cam having a turret and a tool component is used to obtain the necessary transverse movement of the grooving tool. An adjustable roller-stop assembly is bolted to the top of the tool cam. As the turret advances toward the work, the roller contacts a stop secured to an overhanging strap mounted on the lathe headstock. This forces the tool cam in a direction at right angles to that in which the turret cam is traveling, and feeds the grooving tool into the work bore at the rate of 0.003 inch per revolution.

Fig. 4. Details of fifth position turret tooling for setup seen in Fig. 3. Grooving tool is fed transversely by action of roller stop as turret advances.



With the tooling at position six on the turret, a water pump body surface 5.000 inches in diameter is turned, with the tool fed at the rate of 0.007 inch per revolution. All operations on the small-diameter end of the casting are performed with a work speed of 188 R.P.M.

These are but a few of the applications by means of which ram type turret lathes have been placed in the class of automatic machines. Processing, tooling, setup, and operation of the lathes have all been simplified, and even the smallest quantity of parts can be produced automatically and economically. In many cases, the operator can attend two or more machines, or perform some other function while the lathe is going through its automatic cycle.

Glass-Fiber Brush Facilitates Aluminum Soldering

A recent laboratory development in the soldering of aluminum is proving to have wide practical application. Special materials and techniques are required to solder this metal because of a tough oxide film on the surface that interferes with tinning. Also, the metal characteristically conducts heat rapidly away from the point of application.

In the latest method of soldering aluminum, a glass-fiber brush is employed as a special tool to remove the oxide coating by abrading the metal through a layer of molten solder. Adaptation of this simple technique to high-production industrial equipment promises to greatly increase the application of aluminum assemblies that require good-quality soldered parts.

The glass-fiber abrading tool is a new product that will soon be available from many different sources. The English firm of Tiltman Langley, Ltd., developed the brush and a special low melting point, corrosion-resistant solder for aluminum alloys. However, the brush performs equally well with other solders and metals. Reynolds Metals Co. has acquired exclusive manufacturing and distribution rights for the brush and solder in the United States and Canada.

The brush is simple, economical, and easy to use. Only two steps are involved to produce sound soldered joints. First, pre-tin all edges that will be joined by heating the joint area, melting solder to form a pool and rubbing the metal surfaces beneath the molten solder with the glass-fiber brush.

Second, assemble the tinned parts and clamp to hold them together. Then apply heat to melt additional solder on the tinned area to form the fillet or fill the joint area. While the solder is still molten, smooth the fillet with the glass-fiber brush.

Do not use excessive pressure when abrading the aluminum surface. A light brushing action is sufficient to remove the aluminum oxide from spots on the work surface. Then, once started, the tinning action will tend to assist the glass-fiber brush in removing the aluminum oxide film from the remainder of the work surface.

The good results achieved with the glass-fiber brush are due to the particular characteristics of the glass fibers themselves. The most important factor is that they do not conduct heat easily. This means they do not cause the overlying layer of molten solder to freeze. Thus, by remaining molten and active, the solder can bond readily with the aluminum as the oxide is removed.

The brushing action also facilitates the deposition and bonding of the solder. Aluminum oxide is dislodged by the glass fibers without severely abrading the surface of the underlying metal. This prevents excessive alloying, yet assures correct bonding action. Any fibers that may break off during brushing will rise to the surface of the molten solder layer and therefore maintain the corrosion resistance of the joint.

The glass fibers in the brush are densely packed and do not flex appreciably. This gives the brush a stiff action, making solder control relatively easy.

New tools, using the brush principle, are sure to be developed. By combining a glass-fiber brush and a heating element in a single tool, a source of heat and an abrasive device could easily be controlled with one hand. Another combination that would have great usefulness would be a glass-fiber brush with a hollow center through which solder wire or rod could be fed direct to the abraded aluminum surface.

* * *

Tool Wear Studied with Radioactive Isotopes

Radioactive isotopes are being used at General Motors Technical Center to study certain phases of both production tool and automotive engine wear. This was reported by Dr. Alexander Somerville at the National Industrial Conference Board's fifth annual conference on Atomic Energy in Industry. Tool wear studies are conducted with a large production type lathe. By using short, half-life, tungsten-187 material, a very high sensitivity is obtained, and the difficult contamination and disposal problems are reduced. One microgram of tool material can easily be measured in the chips. This amounts to the material worn off during one second of operation.

TV on the Spot

"Bird watchers" are on the way out at Ryan Aeronautical Co., San Diego, Calif. And no one is at all sorry about it.

Actually, the bird watchers are without ornithological connotation. They are a group of employes whose job it is to inspect the bottoms of spot-welds. Inspection must be made while the welding is in progress. Seated in a pit beneath the welding machine, his eyes glued overhead, the inspector's chief occupational malady has always been a stiff neck. Now he is being successfully replaced by a novel application of closed-circuit television.

Spot-welding of aluminum structures is a Ryan specialty. An exacting production process, it requires careful control to assure high quality. Because of the heat and pressure involved, the copper welding electrodes soon pick up the cladding—a layer of pure aluminum which covers the harder alloy-base metal. Since the cladding prevents corrosion of the metal, it is important to keep the pick-up to a minimum. Tips of both welding electrodes must be cleaned when deposits become noticeable.

An experienced welder has little difficulty determining when the tips need cleaning. He can either feel the stickiness of the tips as deposits build up or actually see the difference in the surface appearance of the welds. But he can, of course, inspect only the tops of the welds. Another man—a bird watcher—has had to sit under the welding platform and inspect the bottoms of the welds, as shown in Fig. 1.

This method has long been a thorn in the sides of the company's methods engineers. Simultaneously, they explored three possible solutions: prisms and optical lenses, mirrors, and closed-circuit television.

TV provided the answer. With electronic accuracy and clarity, a television camera, Fig. 2, now stares untiringly at the bottoms of the welds and transmits a magnified report via coaxial cable to a 17-inch picture tube at the side of the welder. At one glance, the operator himself inspects both tops and bottoms of the welds, as can be seen in the heading illustration.

The only problems were the positioning of the camera to accommodate the four-way movement of the parts through the welding machine, and the proper lighting to obtain the best image on the tube. Lighting took a great deal of experimentation. Aluminum, of course, is shiny, and the hourglass reflections of the welds were especially troublesome. It was found that fluorescent lights eliminated the glare, but were not strong enough to assure a clear picture. A combination

Fig. 1. "Bird watching" demanded the services of a skilled inspector, and rewarded him with a stiff neck for his efforts.

of fluorescent and incandescent floodlights now does the trick.

Complications produced by the longitudinal and crosswise movements of the structural panels, as well as the constantly changing field of vision, were overcome with a movable camera, set up on an arc with a simple bracket. Powered remotely, the camera is operated by a flip switch and follows with ease the line of welding in any direction.

Use of two lenses on the camera has an advantage: A close-up lens provides a detailed image; and a wide-angle lens shows a larger area, enabling the welder to remove the work from the narrow clearance between the welding tips without bumping.

"Refinement of the system will continue for as long as we use it," says Don Post, assistant supervisor of methods engineering, "but the success of the program is already proved. It not only frees a skilled worker for another job, it improves quality by showing cladding pick-up the instant it starts, on an enlarged 5-inch spot-weld on the TV tube."

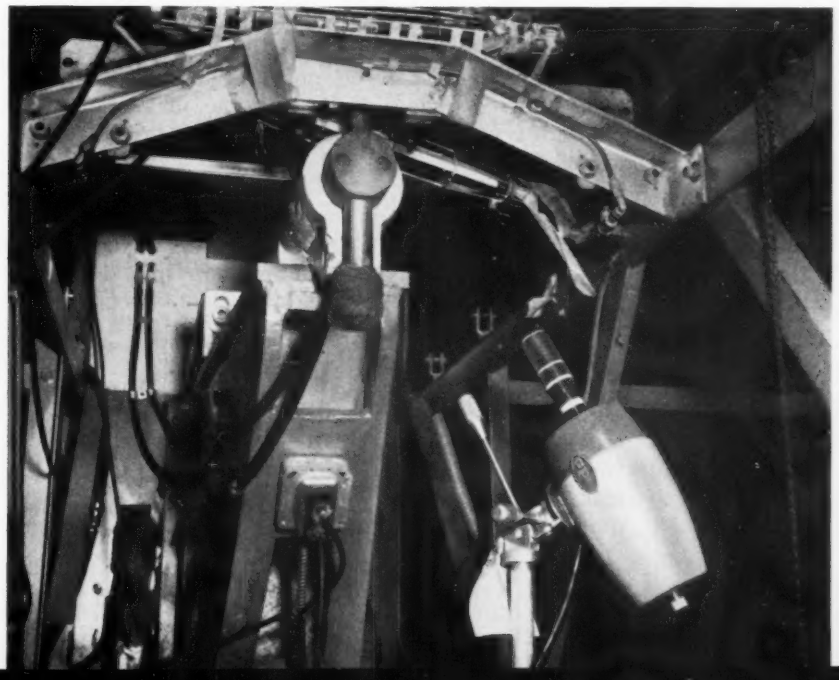


Fig. 2. The television camera takes over, producing a 5-inch enlargement of each spot-weld on the picture tube at the side of the welder.

A broach-insert blank of M-2 steel is shown being checked while held on the magnetic chuck of a vertical-spindle surface grinding machine. The insert rests on top of a rod and is held between four magnetic blocks.

Surface Grinding of Broach-Insert Blanks

THE spacing, shape, face angle, and step-down which determine the cut taken by a broach tooth must all be precise. When making broaches or broach inserts, the care exercised in the finishing of the teeth will be ineffective unless the surfaces of the tool blank have first been carefully machined.

To insure primary accuracy, the American Broach & Machine Division of Sundstrand Machine Tool Co., Rockford, Ill., has adopted a novel method of machining broach-insert blanks. The operation is performed on a Mattison surface grinding machine of the vertical-spindle type equipped with a magnetic chuck.

In an operation of this kind, it is imperative to guard against any springing of the work by the magnetic chuck. If distortion should occur, the tool blank would be under stress while the first surface is being ground. Then, when released from the chuck, the work-piece would spring back at one or more points, so that the ground surface would no longer be in one plane. Also, when the piece is turned over and pulled down tightly on the chuck, it would again be sprung from its normal position by an amount equal to the discrepancy present in the first surface.

To avoid this difficulty, a small-diameter bar of steel is placed under the broach insert and the insert is held between two pairs of magnetic blocks which are positioned on the magnetic chuck. These auxiliary blocks hold the work-piece truly vertical. The steel bar makes only a line contact with the broach insert and this prevents the work-piece from being held magnetically with any great degree of force. Since this procedure eliminates the possibility of a deforming stress being applied by the magnetic chuck, it is accepted practice for grinding broach inserts.

The insert seen in the illustration is 3 1/2 by 1 1/2 by 45 inches, and is made of M-2 steel. The grinding wheel speed is 700 R.P.M., using a Norton wheel made of 32 Alundum abrasive, H grade, and No. 8 structure. A coolant is employed for this operation.

With a very slow table speed and a feed of 0.002 inch, 0.125 inch of stock is removed. Tolerances are held to within 0.001 inch on parallelism and 0.005 inch on flatness. Approximately twenty pieces per hour can be processed in this manner with comparatively little time being required to set up the work.

Latest Techniques in Extruding Aluminum

Increasing demand for aluminum extrusions has led to expanded facilities, improved methods, and larger presses. Extrusion presses at Kaiser Aluminum's Halethorpe plant vary from an experimental 500-ton unit to two 8000-ton machines. First of two articles.

By CHARLES H. WICK, Managing Editor

ONE of the fastest growing metalworking methods is extrusion. The production of aluminum extrusions in this country alone has jumped from approximately 260 million pounds in 1946 to 750 million pounds in 1955, and some predictions for 1957 output forecast more than one billion pounds. Also, the number of companies extruding metal has grown from eight in 1947 to an estimated 135 in 1957.

Many reasons exist for this tremendous expansion. First, extrusions introduce numerous possibilities for more economical and efficient product design. Various shapes that are costly to produce by casting, rolling, or machining can be extruded economically. Advantages of aluminum include availability, lightness, good strength characteristics, attractive appearance, and high resistance to corrosion. It can easily be joined and machined. Also, the cost of aluminum has remained relatively stable for many years, while the price of other materials has been constantly climbing.

To meet the increased demand for aluminum extrusions, a $6,250,000 expansion program is nearing completion at the Halethorpe, Md., facilities of Kaiser Aluminum & Chemical Corporation. Three new Birdsboro 2750-ton presses have been installed, and a fourth 3500-ton tube extruding press will soon be erected. The program will give Kaiser eight presses at Halethorpe and raise the plant capacity from 24 to 46 million pounds of extrusions per year. Prior to the expansion, the company had 4 per cent of the total business—the eventual goal is at least 15 per cent.

Kaiser's facilities at Halethorpe include two modern plants which are physically adjacent—a Heavy Press Plant operated under a lease as a major U. S. Air Force facility in the foresighted Heavy Press Program, and a Light Press Plant owned by the company. In the Heavy Press Plant, where two 8000-ton presses are in operation, extrusion ingots (or "logs") are produced by the direct chill process. Aluminum alloy is melted in any one of four reverberatory furnaces, each having a capacity of 50,000 pounds in the melting hearth and 30,000 pounds in the holding hearth. These furnaces can melt 15,000 pounds of metal every hour.

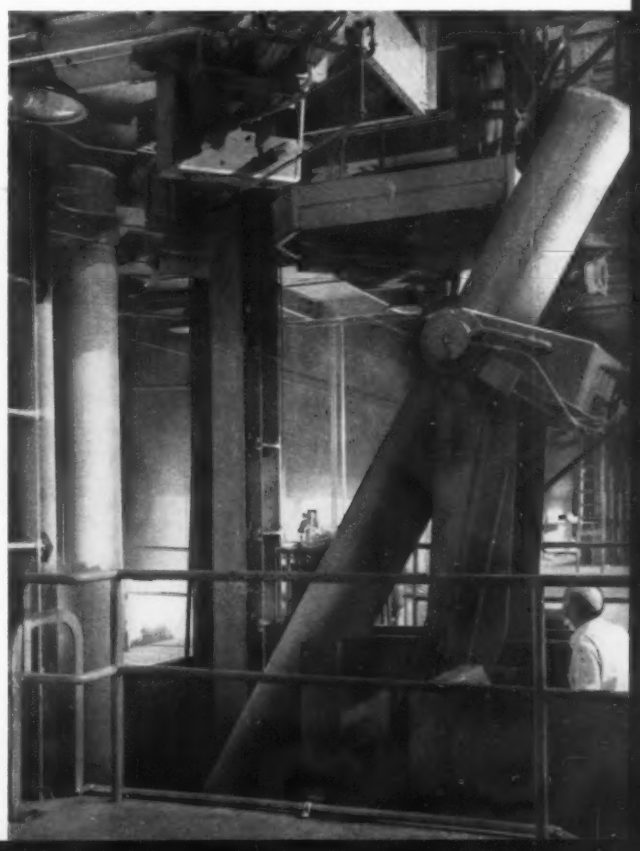


Fig. 1. Aluminum-alloy ingot, 20 inches in diameter by 25 feet long and weighing approximately 8000 pounds, is being automatically lowered from casting unit.

Fig. 2. Two 8000-ton presses, 126 feet long, are capable of extruding aluminum shapes over 100 feet in length at the rate of 15 feet a minute.

Molten aluminum alloy, completely degassed and cleansed of impurities, is admitted to the top of one of two semicontinuous casting units. Each unit contains a water-cooled, open-end mold positioned over a pit containing a hydraulic elevator that is lowered at a uniform rate. Attached to the elevator is a platen which closes off the bottom of the mold. As solidification starts and the platen descends, a solid aluminum log emerges below the casting unit. The huge logs are automatically lowered, Fig. 1, and conveyed to a weighing station by means of a power roller system.

Ingots from 5 to 20 inches in diameter and up to 25 feet long (weighing nearly 8000 pounds) are produced on these units. Under a manufacturing methods development contract awarded by the Air Materiel Command, the company has successfully cast sound, high-strength aluminum-alloy ingots up to 32 inches in diameter.

Each ingot is checked visually and ultrasonically to detect any porosity, cracks, or inclusions. Defective areas are removed by sawing, and remelted. Then, the ingots are given a homogenizing heat-treatment by soaking at temperatures just below their melting points in car type, 100,000-pound capacity furnaces. This treatment provides uniform distribution of the alloying ingredients and relieves residual stresses which may have developed in the casting process.

Completely equipped physical, metallurgical, and chemical laboratories are provided to insure proper grain structure, correct composition, and specified properties. Included are a spectrometer,

Fig. 3. Control pulpit for one of the 8000-ton extrusion presses. Controls include a selsyn system, servomechanisms, and a total of sixty-seven limit switches on each of the presses.

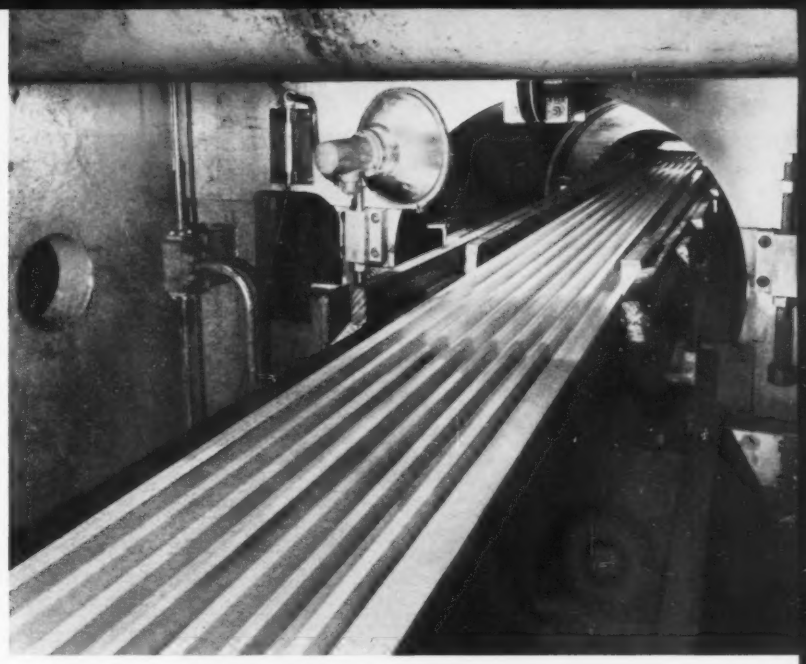


Fig. 4. This close-up view of the exit end of an 8000-ton press shows an aircraft wing panel section being extruded. Panel is 17 inches wide.

a direct-reading Quantometer, metallography equipment, and tensile testers. A shop for producing extrusion dies contains nearly 100 different machine tools and items of auxiliary equipment. An unusual feature of this shop is that the dies are made on a production-line basis—each man performing one or two successive operations instead of making the entire die.

Ingots are cut into required billet lengths on a Loma sawing machine having a 55-inch diameter saw blade, powered by a 100-H.P. motor. This machine can cut through a billet of 7075 aluminum alloy, 20 inches in diameter, in thirty-five seconds. Some ingots are cast hollow to be used in extruding large tubes. For smaller tubes, the solid ingots are core-drilled on a special horizontal machine driven by a 75-H.P. motor.

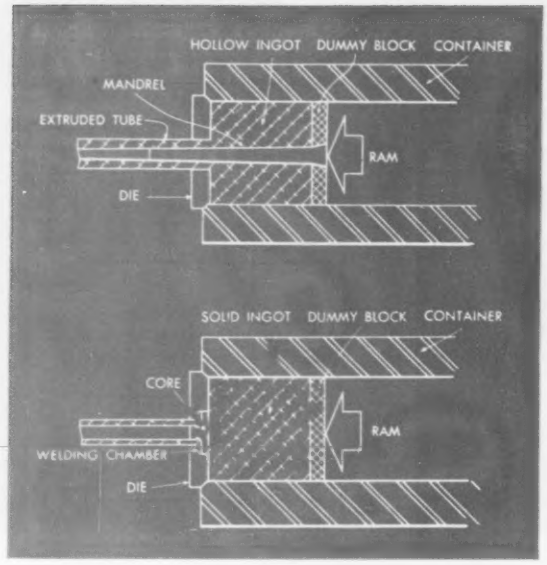
In the Heavy Press Plant, billets are extruded on two identical 8000-ton presses, Fig. 2, named Rex and Regina. These presses, which are 126 feet long, were built by the Loewy-Hydropress Division of the Baldwin-Lima-Hamilton Corporation. Pressure is supplied to both presses from a central, air-loaded accumulator system. The system consists of five 1000-H.P. electric motors, each operating a 336-gallons-per-minute pump. Water, at a pressure of 4500 pounds per square inch, is stored in four, 2400-gallon capacity accumulator bottles having laminated steel walls 8 inches thick. Air, stored in ten similar bottles, acts directly on the water to maintain virtually constant pressure during the extrusion stroke. Supply water is stored in a 12,000-gallon suction tank.

Each press has three main cylinders—two having a stroke of 12 feet and exerting an effective extrusion pressure of 5400 tons, and one mandrel cylinder having a stroke of 17 feet and exerting a pressure of 2700 tons. Two pre-fill bottles (seen at the lower right in Fig. 2) provide a rapid ram advance of 50 feet per minute and a maximum ram speed of 15 feet per minute during extrusion, allowing twenty-four extrusion cycles per hour.

Billets to be extruded are heated to a temperature between 700 and 900 degrees F. by means of six Magnethermic 60-cycle, induction-heating units located between the two 8000-ton presses. Each heater has a capacity of 4000 pounds per hour and requires about one minute per inch of billet diameter to impart the desired temperature. The exact temperature specified depends on the alloy and the cross-sectional area to be extruded.

Heated billets are automatically moved into position between the container opening and ram of the press. Press operation is controlled from a pulpit, Fig. 3. The control system includes selsyns, servomechanisms, safety interlocks, and a total of sixty-seven limit switches. A resistance heating unit built into the billet container maintains the temperature and plasticity of the billet during extrusion. While most shapes are extruded from 20-inch diameter billets, the presses are capable of handling billets up to 26 inches in diameter by 58 inches long. Extrusions exceeding two feet in width have been produced from 20-inch diameter billets by using special techniques developed at Halethorpe. Prior to extrusion, the dies are preheated in a furnace located between the two presses.

When the hot billet contacts the die, which is held tightly against the back end of the container by a locking device, pressure builds up rapidly, and the metal begins to extrude through the die in the shape of the die opening. Fig. 4 shows a



17-inch wide aircraft wing panel section leaving the exit end of one of the 8000-ton presses. Depending on the alloy and cross-section being extruded, only from 85 to 95 per cent of the billet is generally extruded. Samples sawed from the tail ends of the extrusions are etched and inspected to insure soundness.

At the end of the forward ram stroke, the die assembly is released from its position at the end of the container. When moved, the billet butt and die stick together. A hydraulically operated shear is raised to break the butt from the die. When required, a hot caustic solution is sprayed on the die and ram to remove bits of aluminum which occasionally build up on their surfaces. The die assembly is then repositioned against the container, a new billet is loaded, and the cycle repeated.

Hollow extrusions are produced from hollow billets by means of mandrels or from solid billets by means of porthole type dies, as illustrated at top and bottom, respectively, in Fig. 5. Mandrels can either be floating or attached to the ram. The 8000-ton presses are equipped with a sliding member within the ram to which the mandrel can be attached. This arrangement permits movement of the mandrel independent of the ram motion, and allows the production of tubular shapes having tapered or stepped interior configurations. With porthole or spider type dies, the billet is divided into two or more segments which flow around the core supports and are then welded together under the extrusion pressure to form the desired shape.

Stepped extrusions are growing in importance, spurred by the need for smaller volume, lighter weight members—particularly for aircraft. In producing stepped parts, the smallest or minor section is extruded first. After the desired length of this cross-section has been produced, the press is stopped and the dies are changed to produce the larger or major configuration. The dies are generally split into two segments, as illustrated

Fig. 5. (Above) Hollow extrusions are produced from hollow billets by means of a mandrel, as seen at the top. Porthole type die (bottom) is used for extruding intricate hollow shapes.

Fig. 6. (Right) Schematic drawing of setup for extruding stepped parts. The press is stopped when ingot is partially extruded, and dies having larger openings are mounted.

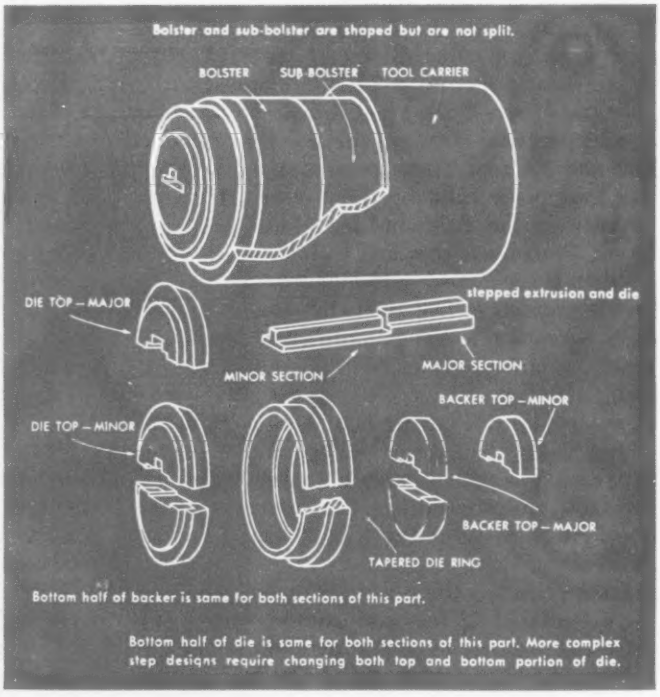

Bolster and sub-bolster are shaped but are not split.
BOLSTER
SUB-BOLSTER
TOOL CARRIER
DIE TOP – MAJOR
stepped extrusion and die
MINOR SECTION
MAJOR SECTION
BACKER TOP – MINOR
DIE TOP – MINOR
BACKER TOP – MAJOR
TAPERED DIE RING
Bottom half of backer is same for both sections of this part.
Bottom half of die is same for both sections of this part. More complex step designs require changing both top and bottom portion of die.

Fig. 7. Immersion type ultrasonic inspection unit having a tank 68 feet long by 4 feet wide and 30 inches deep, for the non-destructive testing of large extrusions.

diagrammatically in Fig. 6, to facilitate removal of the dies from the extrusion. If single-piece dies are used, the minor die must be stripped off the end of the extrusion and the major die mounted over the end of the minor section.

Future developments considered feasible include the production of step extrusions having a major section on both ends, parts having the major cross-sectional section in the center, and tubes having internal or external steps at either end of the tube or in the center.

Finishing of the extrusions varies with their design and application. Extruded channels and similar sections are heat-treated (when required) in a Westinghouse horizontal, 110-foot long radiant tube furnace. The quench chamber at the furnace exit is equipped with water nozzles for flood quenching at the rate of 30,000 gallons per minute. Tubes and other hollow extrusions are heat-treated in a Swindell-Dressler vertical, 50-foot high, 10,000-pound capacity electric furnace. A quench tank, 50 feet deep, is provided below this furnace.

Residual stresses in the extrusions are relieved, a 2 per cent permanent set is imparted, and the parts are straightened on a Loewy-Hydropress 750-ton hydraulic stretching machine. Each end of the extrusion is clamped in hydraulically operated jaws, and both heads of the machine can be revolved for detwisting the work. A Sutton detwister, capable of exerting 3,000,000 inch-pounds of torque on extrusions is also provided.

Critical aircraft extrusions are ultrasonically inspected on the special immersion type unit shown in Fig. 7. The extrusions are placed in a tank 68 feet long by 4 feet wide and 30 inches deep. The tank is filled with water to which potassium dichromate is added as an inhibitor. For inspection, the quartz crystal scanning unit of a Sperry Reflectoscope is traversed along the submerged extrusion at variable rates up to 30 feet per minute. The instrument electronically generates ultrasonic vibrations and sends them in a pulsed beam into the extrusion. Any discontinuity, as well as the bottom surface of the work, reflects the vibrations back to the instrument. The elapsed time between the initial pulse and the return of the reflections is measured, and the time lapse is visually indicated on a cathode-ray tube.

Vertical pips along the reference line on the screen indicate both the nature and location of defects such as stringers, inclusions, and porosity. Immersion testing has been proved more satisfactory than contact type non-destructive testing for irregular-shaped surfaces, and it permits the use of a wider range of testing frequencies. Test blocks having known "defects" in the form of drilled holes of various depth are used to calibrate the instrument or compare the indications with those received from the extrusion.

Extrusion techniques employed with new 2750-ton, oil-hydraulic presses in Kaiser Aluminum's Light Press Plant will be described in a second and concluding installment to be published in June MACHINERY.

Ultrasonic Cleaning of Precision Gear Reducers

PRODUCTION of precision components requires exact manufacturing methods—including, in many instances, thorough cleaning. For example, the extreme care taken in the production and assembly of the gear speed reducer shown in Fig. 1 is to no avail if the unit is not cleaned properly. Designed and produced by the Bowmar Instrument Co., Fort Wayne, Ind., these units are mounted on servo motors for airborne computers in B-52 aircraft. Each unit contains more than fifty precision parts, including gears (AGMA Class 3) and miniature bearings (ABEC Class 5).

To meet specifications, the backlash in each reducer must be less than 6 minutes of arc when measured with test loads of 1 inch-ounce. This requires that the assemblies be thoroughly cleaned before testing. Even the smallest particle of dirt could cause the driving torque to exceed the specified value.

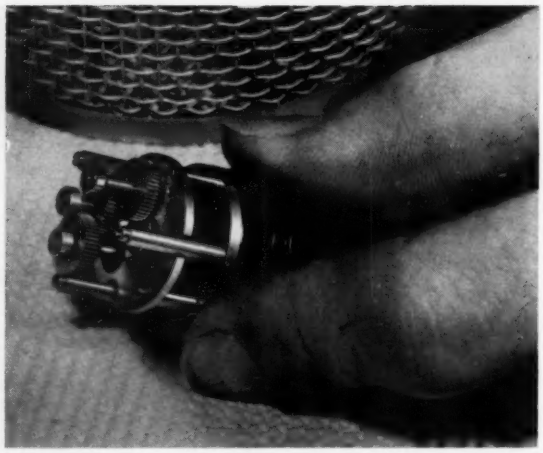


Fig. 1. Close-up view of a three-plate speed reducer. Dirt and other foreign particles have to be removed from the precision gears and bearings to assure that these units meet specifications.

Previously, units of this type were cleaned by spraying with a solvent under pressure. However, this method was slow and unreliable. Dirt and other foreign particles in inaccessible places, such as inside bearings, in tapped holes, or behind

Fig. 2. Operator places several reducers in basket which will be placed inside cleaner shown in background. With this ultrasonic equipment, cleaning is more thorough, as well as faster and more reliable.

Fig. 3. Looking into the working end of the transducer, the violent action of the cleaning fluid is visible. Cavitation caused by a mechanical vibration results in a scrubbing action that removes dirt from inaccessible places.

other parts, could not generally be removed. As a result, the manufacturer was often faced with excessive rejects, faulty operation, or excessive wear of critical elements. Bowmar eliminated these difficulties by adopting ultrasonic cleaning. Now, the reducers are cleaned faster and more thoroughly, rejections have decreased, and product performance has been improved.

The procedure used with ultrasonic cleaners is illustrated in Figs. 2 and 3. The equipment required consists of a generator which supplies electrical energy to a transducer and a container filled with fluid or solvent. The transducer converts electrical energy into mechanical vibration, which in turn produces cavitation in the cleaning fluid. This cavitation is evidenced as a rather violent scrubbing action which can remove dirt and other foreign matter even from places that are inaccessible.

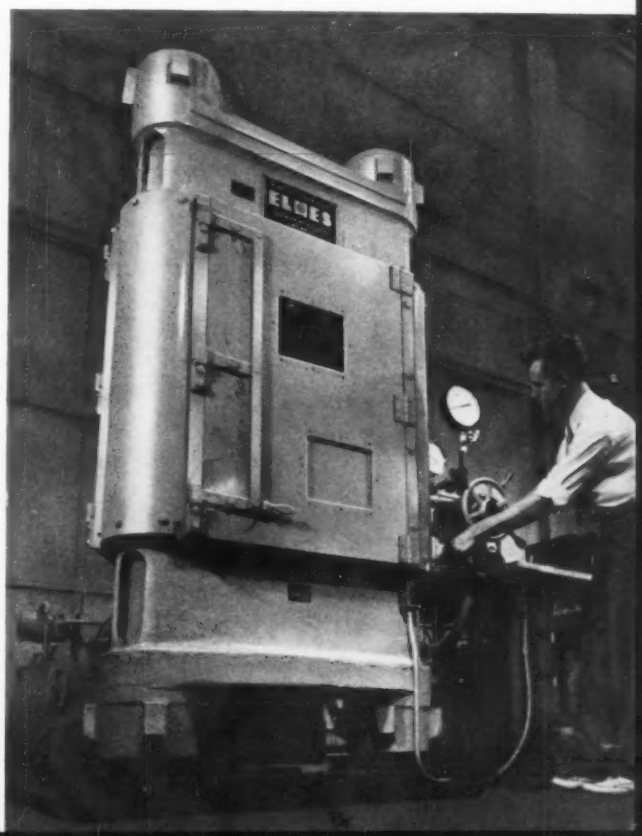
Performance of ultrasonic cleaning equipment is closely linked with the magnetostrictive material used in the transducer. For durable construction, nickel and certain nickel-iron alloys are generally used. With these metals, transducer efficiency can be as high as 90 per cent, and the size and shape of the transducer can be selected to suit the application. In most instances, a laminated type construction offers the best combination of low losses, high capacity, and producibility. The size of the transducer is determined by the volume of fluid used for the cleaning operation; the shape is determined by the operating frequency. The equipment is rated in terms of both frequency and power output. Most units now on the market range in frequency from about 20,000 to 50,000 cycles, and in power output they range from less than one hundred watts to several hundred watts.

Man-Made "Borazon" is Diamond-Hard

An entirely new, extremely hard, man-made material that can actually scratch diamond has been produced at the General Electric Research Laboratory, Schenectady, N. Y. In addition to having about the same hardness as diamond, the new substance, called Borazon, has the advantage of being able to withstand much higher temperatures. Since diamond burns in air at about 1600 degrees F. while Borazon survives temperatures above 3500 degrees F., many industrial applications for this new material are indicated.

Dr. Robert H. Wentorf—a member of the research team that produced man-made diamonds at the laboratory two years ago—discovered Borazon using techniques similar to those successful in the former development. The new material is made by transforming the normally hexagonal crystals of boron nitride into the cubic form. This is accomplished with extremely high pressures—above 1,000,000 pounds per square inch—and temperatures exceeding 3000 degrees F. Some of the equipment employed is shown in the accompanying illustration.

Ordinary boron nitride is very similar to graphite in density and crystal structure. Both materials have a characteristic slipperiness. After transformation of the crystals to the cubic form, the density is about that of diamond. In actual lapping tests, borazon powder has polished away the surface of a large diamond at the same rate as diamond powder. The alternate atoms of boron and nitrogen are packed together almost as closely as the carbon atoms in diamond.



Crystals of boron nitride in cubic form have been produced using a special pressure-temperature vessel enclosed in this hydraulic press

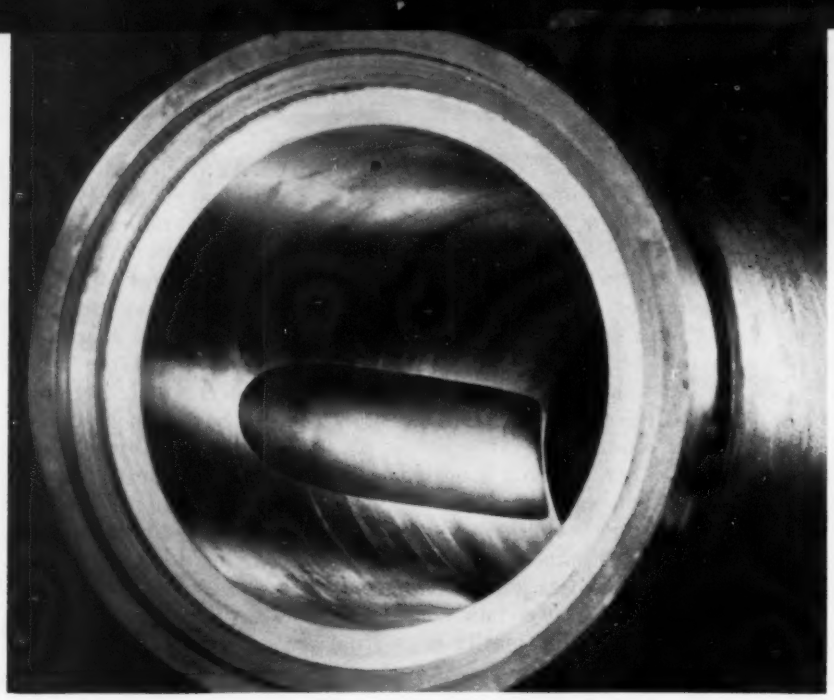
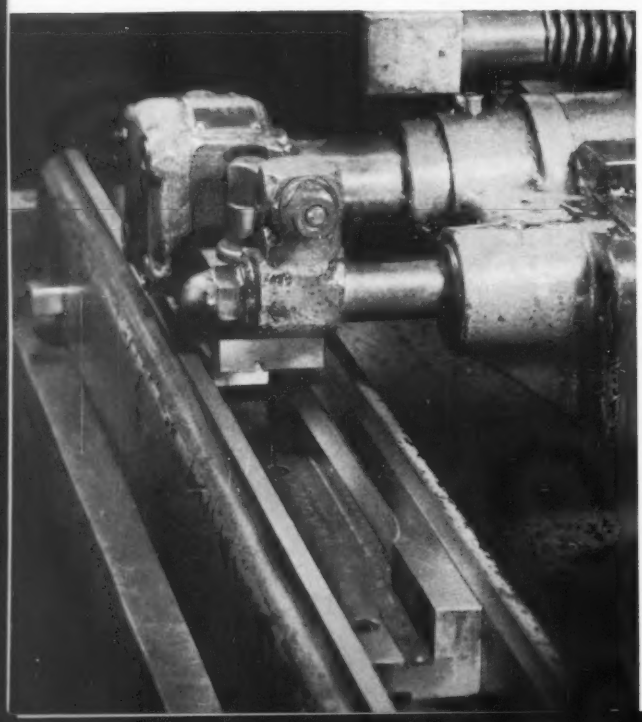


Fig. 1. Contour of oil ports in this buffer recoil cylinder for a naval gun is bored on a standard engine lathe.

Two Unusual Shapes Produced with Standard Machine Tools

Unique tooling in a standard lathe and on a standard shaper was employed to cut two recesses having contours that are not commonly produced with these machines. In both cases 0.001-inch tolerances and smooth finishes are achieved.

By ERIC SAMUELSON
American Machine & Foundry Co.
Brooklyn, N. Y., Plant



THE buffer recoil cylinder in a naval gun has three ports that by-pass oil around the recoil piston. As these internal contour grooves control the amount of recoil absorption by metering the oil, their sizes and shapes are critical. The ports, shaped as illustrated in Fig. 1, were machined in a standard lathe at the Brooklyn, N. Y., plant of the American Machine & Foundry Co.

It was necessary to cut the grooves into the cylinder after it had been welded, heat-treated, bronze-lined, and rough-bored. Since the small diameter of the cylinder discouraged the use of any internal cam control for cutting the contours,

Fig. 2. The tracer mechanism follows a master secured to the lathe taper attachment to guide the cross-slide and the work while boring grooves to the proper contour.

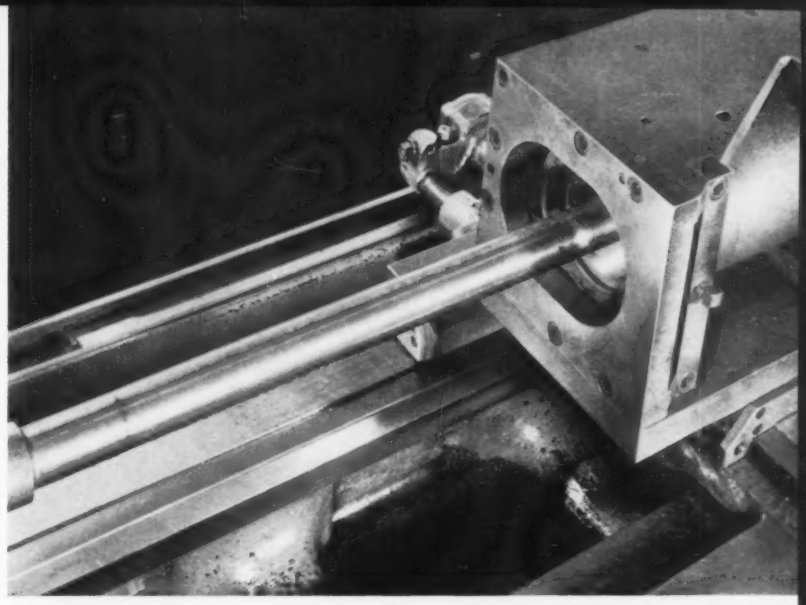


Fig. 3. Cylinder is held in fixture mounted on lathe cross-slide. Three contour grooves are bored by indexing work-piece 120 degrees after each cut.

a unique external tracer arrangement was devised to permit boring of the grooves in a lathe.

The recoil cylinder was clamped in a work-holding fixture mounted on the lathe cross-slide. Movement of the work was controlled by a tracer following a special profile master affixed to the taper attachment, Fig. 2. A carbide-tipped cutter was mounted on a rigid boring-bar extending through the cylinder and held between a lathe chuck and the tailstock center. As the cylinder traveled axially along the boring-bar with the lathe carriage, the cam-like motion of the tracer adjusted the cylinder position radially so that the internal contour was accurately cut. The setup for boring the cylinder ports is shown in Fig. 3.

In performing this operation, the cylinder was indexed 120 degrees to take corresponding cuts in the three grooves. The finishing cut produced a smooth surface and no polishing was necessary.

Contours were quickly and accurately checked with a special inspection fixture that holds a standard indicator. The calibrated fixture shaft and the indicator gave an accurate radial measurement at any specific point along the length of the cylinder axis. This method permitted comparison of corresponding points in each contour and served to determine the true shape of the grooves.

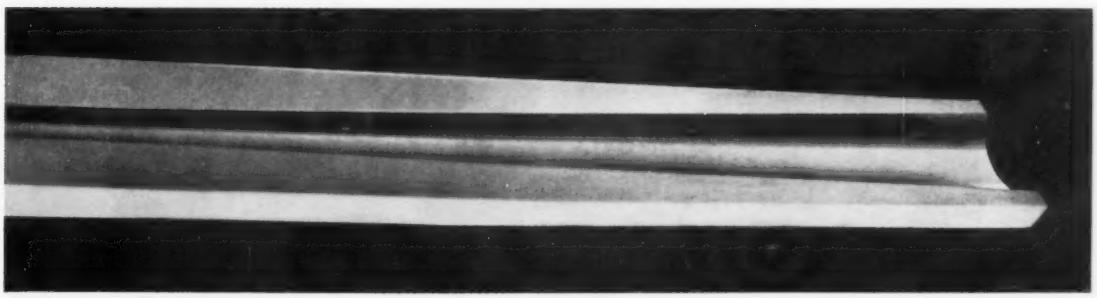
Another unusual operation performed on a standard machine tool involves the production of a component used in the AMF cigarette-making machine. This part, known as a "folder bottom," serves to shape the continuous flat paper ribbon carrying the tobacco into a half cylinder. Then the machine closes and seals the paper around the filler and cuts the resulting tube into cigarettes.

Forming of the moving paper by the "folder bottom" is accomplished in a half-conical channel section (Fig. 4) that tapers into a semi-cylindrical groove having the same diameter as the cigarette. Each different diameter cigarette requires this part to have a groove with a tapered channel section of specific proportions. But in all cases, the base diameters of the half-cones are the same.

The channel must be very smooth throughout its length and the taper must blend accurately into the semi-cylindrical groove. These "folder bottoms" are being machined to the required smoothness in a unique and rigid fixture mounted on a standard shaper, Fig. 5.

After the fixed-radius part of the channel has

Fig. 4. In this part for a cigarette-making machine, the half-cone section of the channel must be smooth and merge into the semi-cylindrical groove at left.



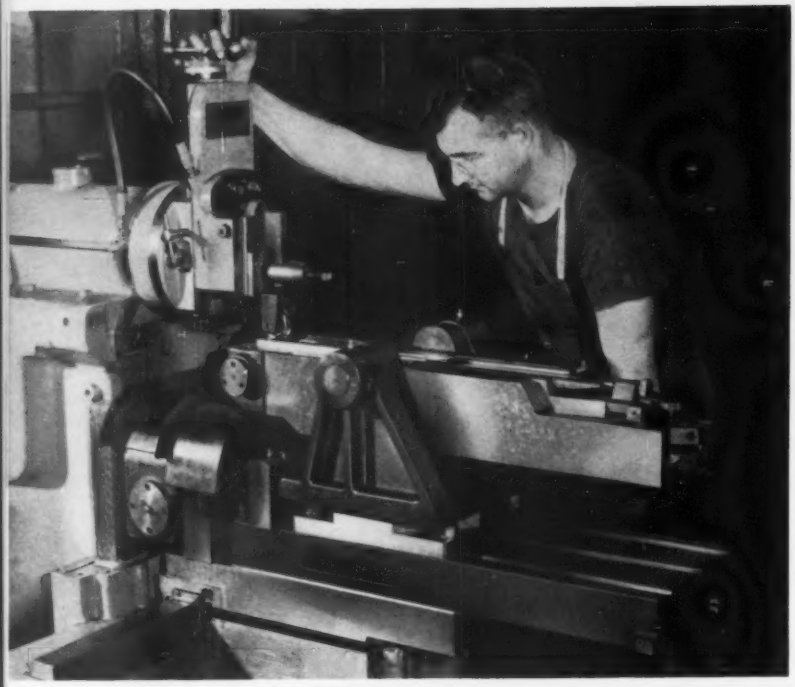


Fig. 5. The work-holding fixture is pivoted to rotate in both the vertical and horizontal planes. Two eccentric drive-shafts position the fixture automatically for cutting the conical channel.

been milled, the stock is set in the fixture to cut the semi-conical section. The work-holding part of the fixture is pivoted vertically on trunnions near the apex of the cone, and the base directly under these bearings is free to rotate in the horizontal plane.

This mounting permits the end of the workpiece requiring the half-conical groove to be positioned for machining. Two eccentric drive-shafts serve to locate the work so that the shaper tool always cuts along an element of the cone. These shafts are located on each side of the fixture and are set to give a fixed diameter to the cone base.

The length of the cone can be increased or decreased by moving the fixture along the slides in the special table. A scale on the side of this table assists the operator in making the adjustment. This unusual operation is seen close up in Fig. 6.

The shape of the radius-forming tool is important, as it determines the blending of the conical and cylindrical grooves. Smoothness of the machined surface has been achieved by minimizing vibration between the cutter and the workpiece. The tool has four cutting edges ground into a solid circular form that can be readily indexed to present a sharp cutting edge when required.

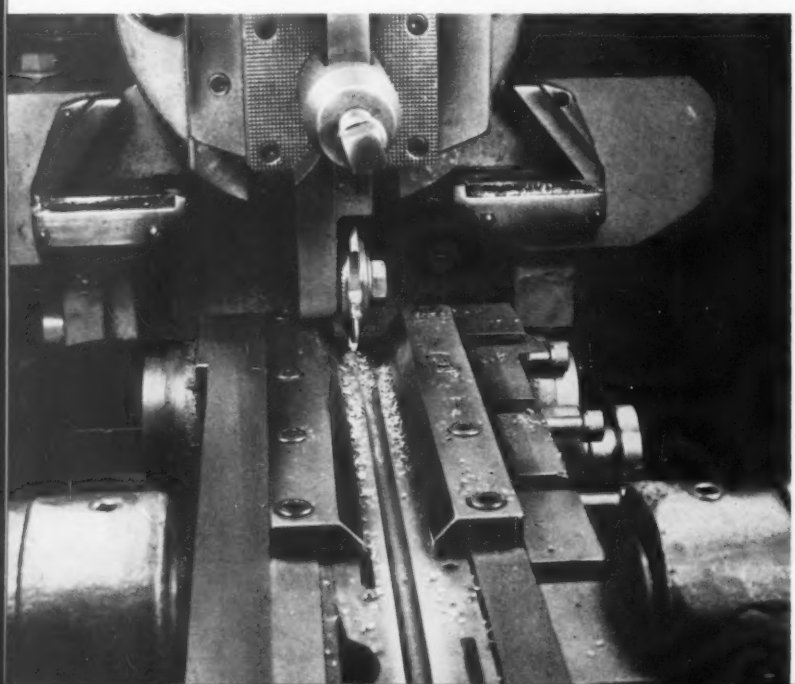
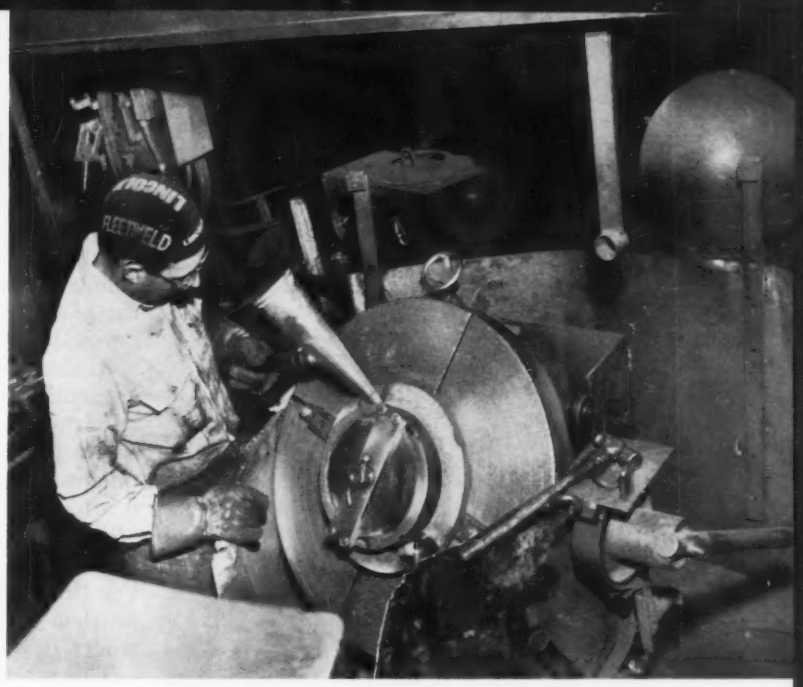


Fig. 6. Here the machining of the "folder bottom" is shown close up. The contour of the form cutter is an important factor in shaping the half-cone.

Welded-Steel Flywheels

By ARTHUR H. ALLEN



TRADITIONALLY, flywheels have always been iron or steel castings, because of inherent inertia properties and moderate material cost. Now, the Lincoln Electric Co., Cleveland, Ohio, is claiming added features for its new flywheel of arc-welded steel fabrication.

For use on the company's gas-engine-driven welding generators, the 15 1/2-inch flywheel is said to give equivalent or better performance than its cast-iron counterpart, and can be fabricated and machined at a cost reduction of better than 40 per cent. An old and a new flywheel are shown, left and right, respectively, in Fig. 1. From the standpoint of mass moment, the new design is considered an improvement, since a high inertia-to-weight ratio is obtained with the bulk of the steel concentrated near the periphery.

A flat circular ring (outer coupling), a rim, and a plate (inner coupling) are the three elements of the welded flywheel. The ring is formed from 1-inch stock, 40 1/4 inches long and 2 1/2 inches wide. Ends are cut at an angle across the width for 1/2 inch to make a square joint. A three-station progressive die in a 500-ton hydraulic press creates the ring shape. Outside diameter is 15 1/2 inches; inside diameter is 10 1/2 inches. Successive forming stages are illustrated in Fig. 2. After the third stage, a gap of 3/16 to 3/4 inch remains at the joint for subsequent slugging and welding.

Flattening at 500 tons pressure, and final sizing at 150 tons pressure in a hydraulic press are the next steps. Then, two steel slugs are welded into the gap, one over the other, with welds being made across the joint on both sides of each slug to fill the gap completely. This is done manually with 1/4-inch rod at 350 amperes, direct-current. Required welding time for the six passes is roughly six minutes. After grinding and reflattening, the part is checked on a surface plate. Rocking must not exceed 1/32 inch, except on sections within 2 inches of the weld.

The rim is roll-formed to an 11 1/2-inch (outside diameter) circle from 3/8-inch thick stock, 2 inches wide. After forming, it is placed on an expandable fixture for sizing. Then, the joint is butt-welded with a 3/16-inch bead on both sides. The beads are stopped 1/8 inch from the edges

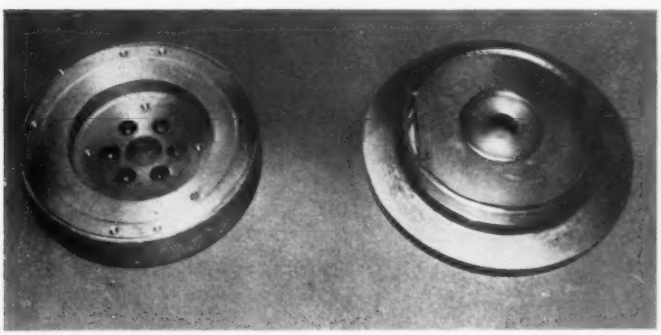


Fig. 1. A cast-iron flywheel (left) and a welded-steel flywheel (right). In new design, a greater amount of total weight is near the periphery.

Fig. 2. Ring is developed from flat stock in a progressive die. The three stages are illustrated.

of the rim, to avoid interference with subsequent circumferential welds.

Third element of the flywheel, the plate, is 9 1/2 inches wide and 3/8 inches thick. It is circular in shape and fits the inside of the rim, except for two 3 3/4-inch chords cut away on opposite edges.

Mounted on a revolving fixture, the plate turns at about 1 R.P.M. to permit fast, semi-automatic depositing of a 4 1/2-inch diameter weld bead on its outer face. Submerged-arc equipment is used with standard 5/32-inch mild steel wire at 590 to 600 amperes current setting and 24 volts. Later, this weld is machined to receive another member. Presence of the bead serves to reduce the plate thickness required and minimize chip removal.

As shown in the heading illustration, the three elements are then positioned and clamped on a revolving table for circumferential welding of the rim to the ring and the plate to the rim. A continuous 3/16-inch weld between the rim and ring is made in fifty seconds, using 3/32-inch wire and 350 amperes current. Between the plate and rim, 1/8-inch welds are made in about forty seconds. For this operation, the fixture table is first rotated on its trunnions to a horizontal position, where downhand welding can be employed.

The assembly next is turned over and four 1 1/2-inch long 3/16-inch fillet welds are made at four points around the joint between the rim and plate. This completes the welding, except for manually "spotting up" any remaining gaps.

Most machining is done on a Gisholt automatic turret lathe, Fig. 3. Cutting speed is 1400 feet per minute, with turret feed, 0.008 inch per revolution. Three stations operate in succession; then the flywheel is reversed and rechucked, and machined from the other three stations. There is a total of fifteen tools on the six stations. Kennametal K-21 carbide-tipped cutters are used throughout the setup. Following the turret-lathe work, various holes are drilled and tapped, similar to those appearing in the cast-iron flywheel in Fig. 1.

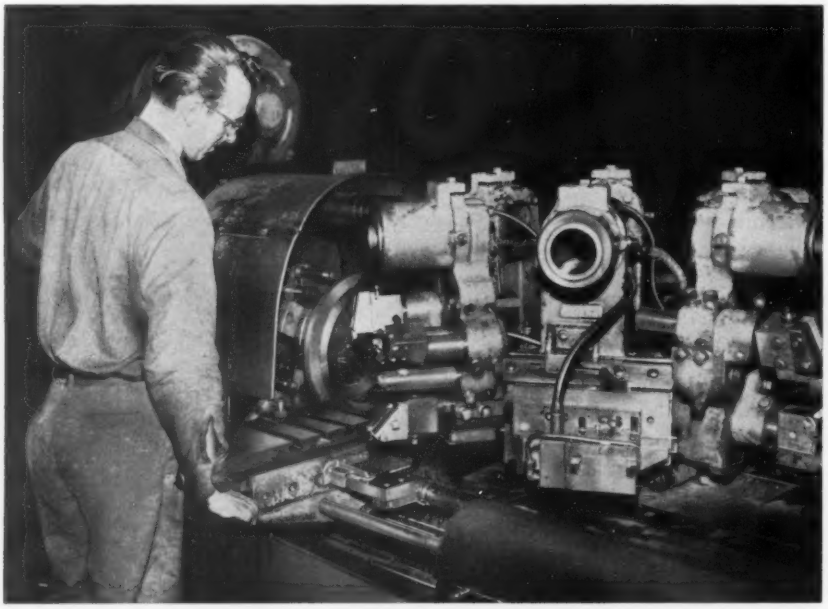
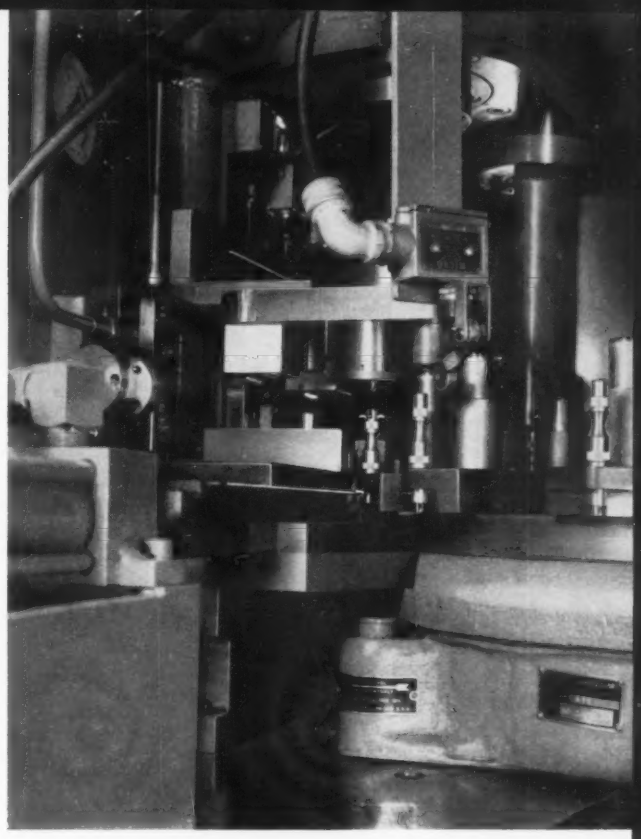


Fig. 3. Turret-lathe machining holds the twelve critical dimensions of the flywheel to 0.002 inch.

Machining and Assembling in One Press Cycle

By
HENRY J. ZUHAK, Chief Engineer
Haber Corporation, Chicago, Ill.
and
ARTHUR W. WILLE, President
Wille Tool Corporation, Chicago, Ill.



A SMALL hydraulic press adapted with a broaching slide, rotary hopper, drill head, and ejector pays off in increased production for a maker of automatic food mixers. The part involved is the mixer beater spindle; and the company manufacturing it is the Haber Corporation, Chicago.

View A, Fig. 1, shows the appearance of the spindle as brought to the press. A hole, not visible, has been drilled through the axis. Operations performed on the press consist of cross-shearing two slots at right angles to each other in the top and broaching another slot across the shank, view B; then trimming the sheared lugs from the top slots, view C; and finally, assembling a bushing over the top and reaming the previously drilled hole, view D.

Basic equipment is a Denison 8-ton Multipress (Fig. 2) with a rotary table which is mounted over a bolster on a 22-inch work circle. The table

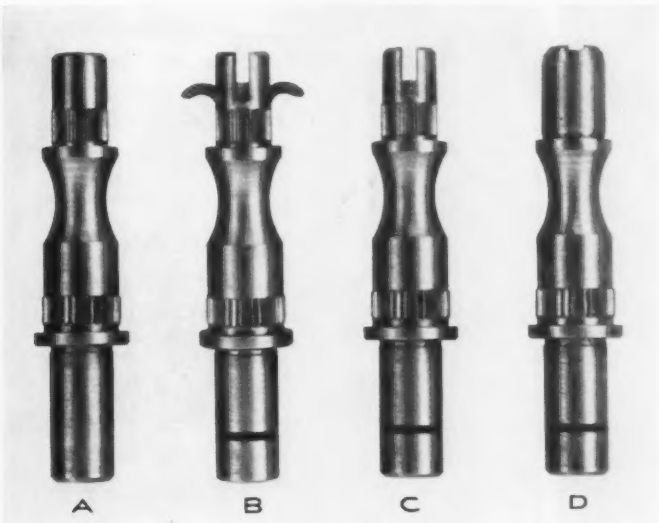


Fig. 1. These views show the beater spindle of an automatic food mixer in various stages of processing.

indexes hydraulically in 30-degree increments. Twelve fixtures are equally spaced around the table, each made up of a flat plate and a shouldered plug. A hole in the plate receives the shank of the spindle.

Indexing is clockwise, with the spindles progressing through various work stations. The press ram, carrying a dual head, operates between Stations 1 and 2. This head supports a four-sided shearing punch directly over the first station and a round trimming die directly over the second station. The bottom of the head also has two sleeves, one over each station. On the press down stroke, these sleeves engage the shouldered plugs of the fixtures then at Stations 1 and 2, and serve to prevent the ram from deflecting.

The steps in producing the beater spindle are as follows: Loaded manually in its fixture, the spindle is indexed to the first station, a close-up view of which appears in the heading illustration. If improperly seated in the fixture, a micro switch is tripped, and this in turn shuts the press down. At Station 1, the punch cross-shears the two slots in the top of the spindle.

When the ram descends to the bottom of its stroke, it dwells there, maintaining full pressure on the shearing punch in order to secure the work-piece. Then, a broach carried on a horizontal slide behind the table advances to cut the slot across the shank. (It will be seen that a section of each fixture plate is milled away to give the broach access to the shank.) The slide, which is operated from a hydraulic cylinder at the side of the press, next retracts, the ram ascends, and the spindle advances to Station 2.

A view from the opposite side of the press, Fig. 3, shows the trimming die about to remove the metal lugs created by the shearing action at Station 1. When the spindle reaches Station 3, Fig. 4, it intercepts a trigger which advances a bushing from the hopper into a transfer mechanism. Then, on the down stroke of the press ram, an air valve is tripped, causing a single-acting cylinder to descend in the transfer mechanism and press the bushing over the spindle.

The next station is idle, and at Station 5, the self-contained drill head unit reams the hole, Fig. 5. A combination clamp and jig automatically

Fig. 2. The basic equipment as it appears with fixtures, broaching slide, hopper, drill head, and ejector.

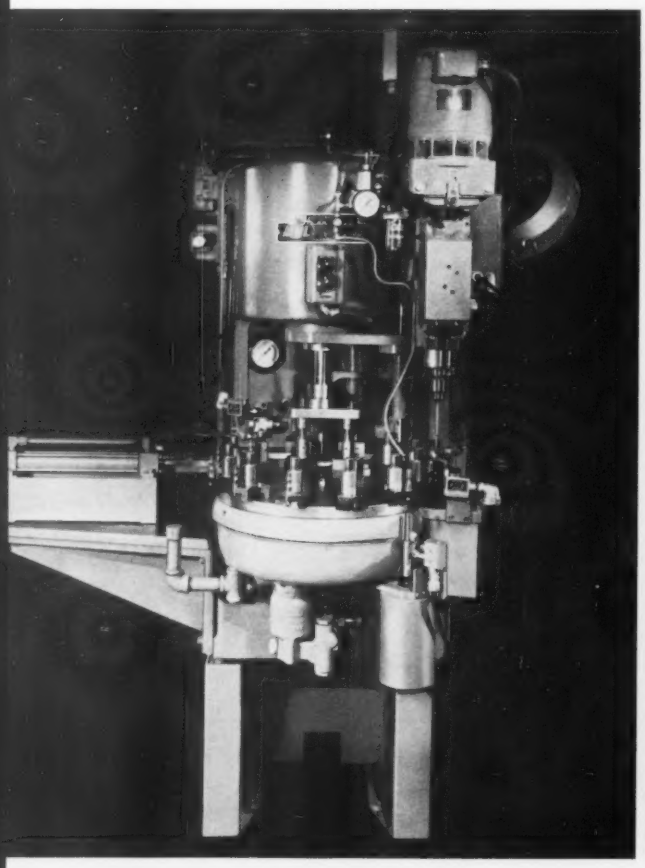
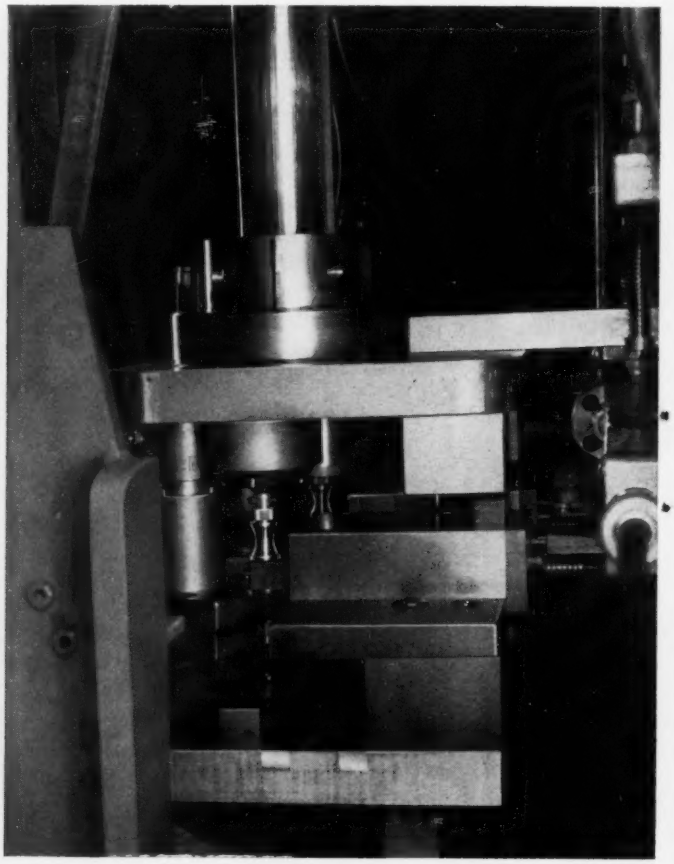


Fig. 3. The dual head of the ram supports a shearing punch over Station 1, a trimming die over Station 2.



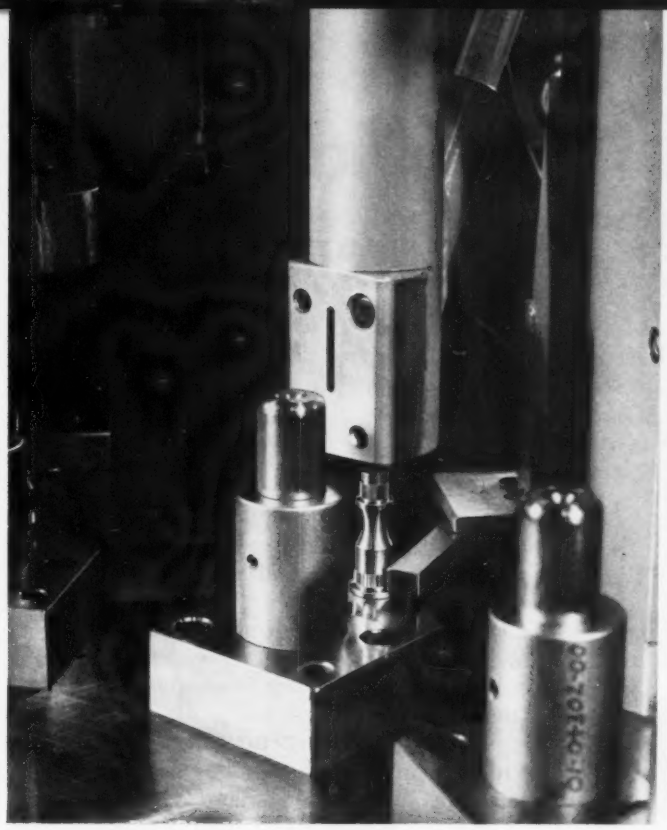


Fig. 4. A cylinder in the transfer mechanism pushes a bushing from the hopper onto the beater spindle.

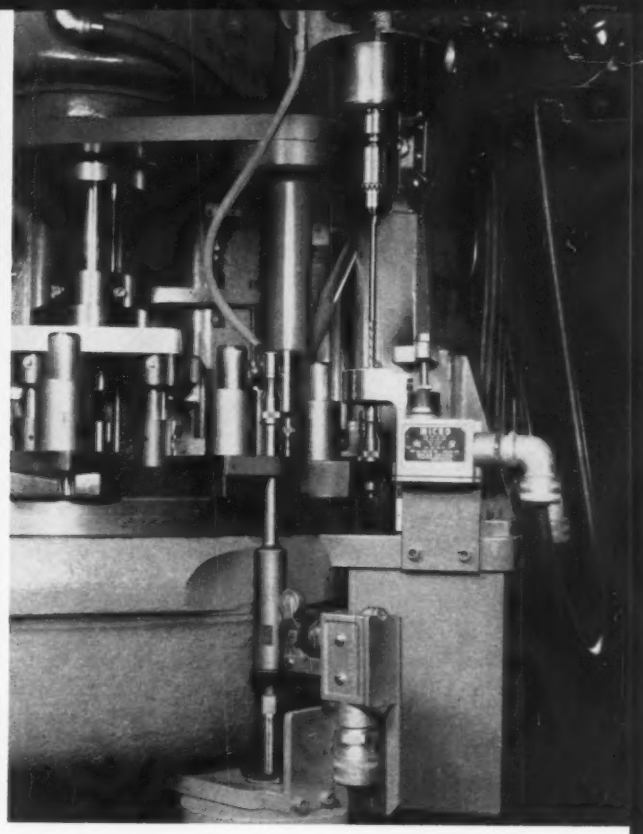


Fig. 5. When a part has been indexed to the reaming station, a combination clamp and jig holds it in fixture.

thrusts the work down before the reamer descends. Finally, at Station 6, seen in the foreground, a small flange-mounted cylinder ejects the beater spindle from the fixture.

All twelve fixtures are continuously reloaded, so that spindles are processed simultaneously at each of the stations. Production is at the rate of seventeen spindles completed each minute.

"Perma-Braze" Process for Carbide Tools

Whitman & Barnes, manufacturers of drills, reamers, and carbide tools, are making public, information regarding a special brazing-hardening process used in the making of their line of carbide tools. Identified as Perma-Braze, the advanced brazing-hardening process utilizes a special high-temperature brazing alloy and unique, scientifically controlled furnace procedures and equipment. This enables the carbide tip to be brazed at the same time the high-speed steel body is hardened.

According to the manufacturer, this results in uniform body hardness and carbide tips that will not loosen due to braze failure. It is further stated that Perma-Braze carbide drills can be used for dry drilling of cast iron without fear of braze softening or melting. Additional information on Perma-Braze carbide tools is available on request from Whitman & Barnes, 40600 Plymouth Road. Plymouth, Mich.

Magnetic Particle Inspection with Water

Successful use of clean tap water plus certain additives as a vehicle for the magnetic particle inspection method was described in a paper read before the Society for Non-Destructive Testing at the recent Tenth Western Metal Congress. The paper—prepared by Vernon I. E. Wiegand and Edward H. Honerkamps, General Electric Co., Cincinnati—stated that oil, conventionally used for this purpose, presents a fire hazard, can cause dermatitis, has a considerable cost, is difficult to remove, and possibly rusts parts during processing and after assembly.

The sensitivity produced by the water solution is equal to that produced by light oil solutions. Rust inhibiting properties of the solution used have proved very effective, and definite material cost reductions will be realized by using water solutions. In addition to these advantages, safety is increased through reduction of fire and health hazards of oils.

Extension-Bed Gap Lathe Efficient for Varied Maintenance Requirements

By Anton E. Sparr
Plant Superintendent
Nassau County Sanitation Disposal Plant
East Rockaway, N. Y.

IT is imperative that a sewage disposal plant be well maintained for continuous operation. The health of a community depends upon the efficiency of the repair facilities maintained at the plant, especially if there is no means for by-passing raw sewage. Sending repair work to contractors on a bid basis may seriously interfere with the continuity of service of the disposal plant.

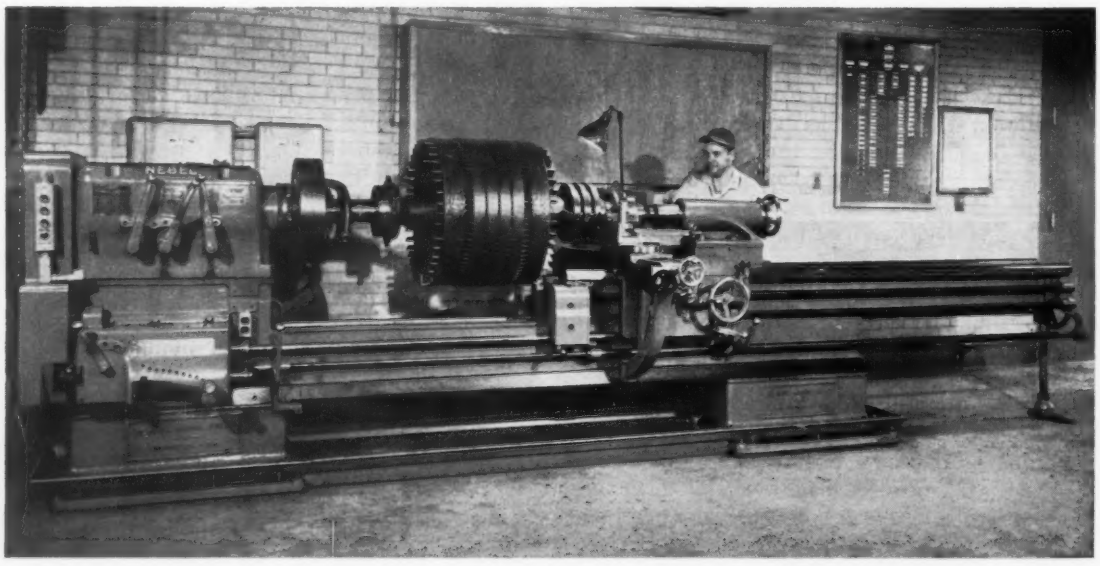
Due to the range of sizes and shapes of the parts encountered in sewage system maintenance, the equipment selected for the repair machine shop must be versatile. At the Nassau County Sanitation Disposal Plant, a 20/40-inch extension-bed gap lathe manufactured by the Nebel Machine Tool Corporation, Cincinnati, Ohio, has proved a judicious choice. This machine is illustrated in Fig. 1.

As an example of the parts requiring preventive maintenance work in the machine shop of this plant is the 4500-pound pump-motor rotor shown in Fig. 2. The pump was taken out of service and both pump and motor were disassembled. The rotor was then placed in the gap lathe, where the slip rings on the rotor were built up and then machined to a 0.001-inch tolerance. The pump impeller and wearing rings were also built up and machined. The units were then re-assembled and put back in service, and this consequently eliminated the danger of breakdown.

Prior to purchase of the extension-bed gap lathe, these rotors would have had to be repaired by contractors. Such parts, although large, are extremely delicate, and can be easily damaged in transit. Maintenance by contract was also unsatisfactory because of the dispersal of parts for repair, the consumption of additional valuable time, and higher costs.

Maintenance work frequently performed on the Nebel extension-bed gap lathe includes the machining of large bearings and long shafting for the purpose of removing rust and corrosion, the machining of worn surfaces, and the building up

Fig. 1. This 20/40-inch extension-bed gap lathe can be adjusted to a variety of swing capacities and distances between centers.



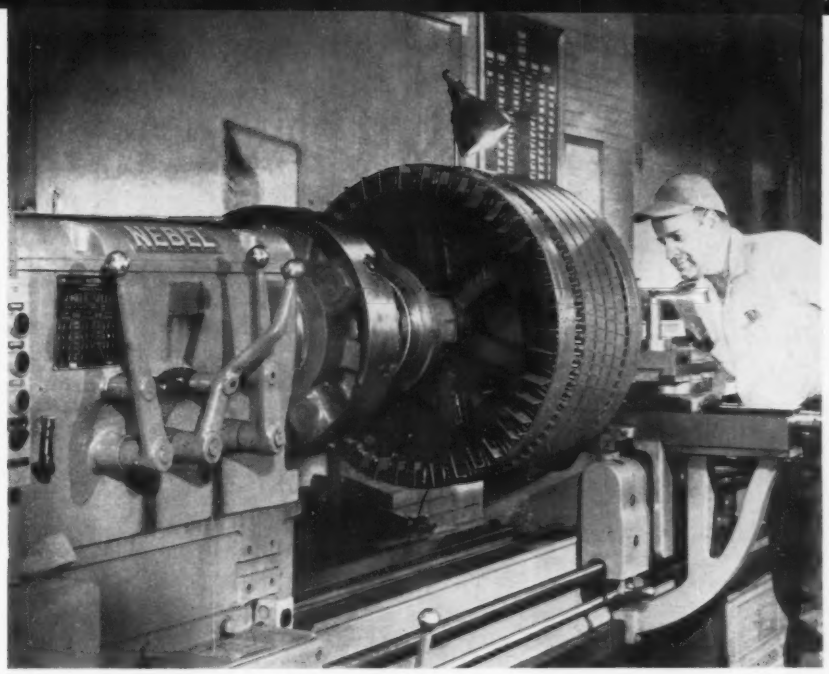


Fig. 2. Maintenance of a 4500-pound rotor, 32 inches in diameter, is easily handled in an extension-bed gap lathe.

of surfaces for remachining. The 38-inch diameter faceplate and jaws which were purchased with the lathe are used for chucking the bearings and other large pieces of equipment..

This lathe is also extremely useful in the production of special tools and gages. Recently, a concrete-core height gage, worth at least $250, was built. This item could not be purchased because it was not in production. In less than two years, one-third of the purchase price of the lathe has been recovered.

As the system is expanded and the pumps become older, preventive maintenance work will naturally increase. Maintenance of the system will then depend in a larger degree upon the versatility of the machine shop facilities.

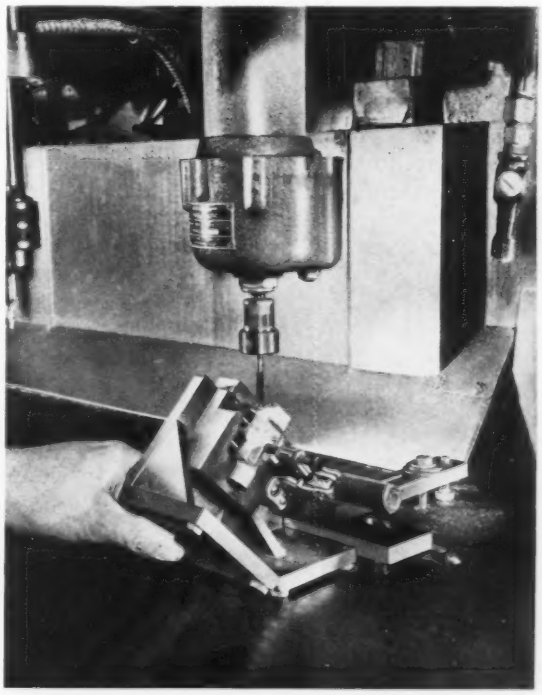
* * *

Epoxy Resins Cut Short-Run Tooling Costs

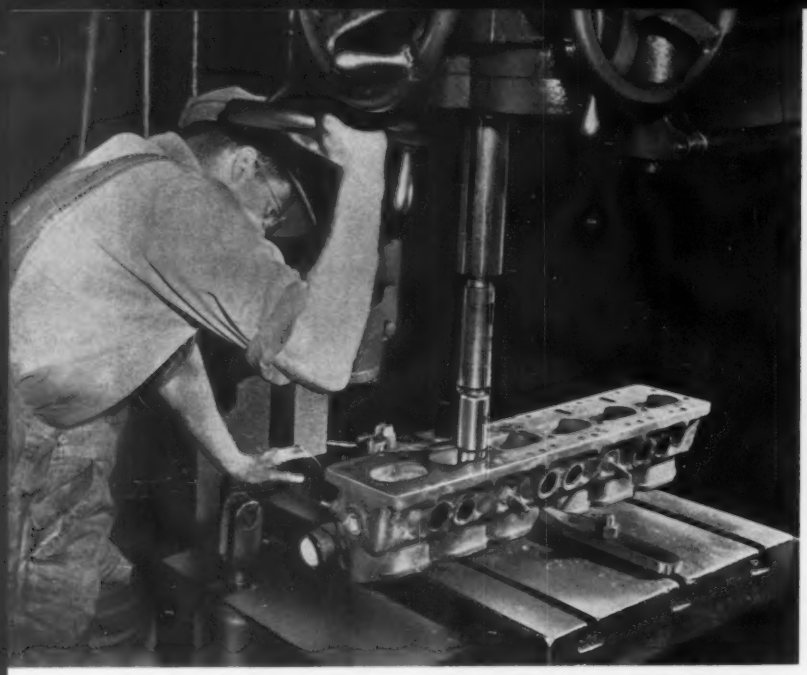
Poured-in-place plastic tools are being used to cut production costs at the Smith Welding Equipment Corporation, Minneapolis, Minn. First cost savings of up to 85 per cent have been effected by making tools such as vise jaws, milling fixtures, and drilling chucks of Rezolin Toolplastik compounds. These plastic materials, which are based on Bakelite epoxy resins, are particularly useful for tools employed in short production runs.

On one critical part, epoxy tools were employed in nine out of thirteen operations and the cost was less than half that of conventional equipment. The use of plastic for the drill jig in the illustration cut loading time by permitting the employment of toggle clips instead of screws for holding the part.

A good fit is always assured, as an actual part is used for a section of the mold in making most tools. Usually, the part can be lined up and the tool poured in about half an hour. After hardening overnight, the part is removed, and the tool is ready for use. Chucking jaws made of these epoxy compounds have handled 10,000 parts without showing signs of wear.



With the combined use of a plastic part-nest and a toggle clamp drill, jig loading time has been reduced.



By using nickel electrodes for the valve seats and nickel-iron electrodes for cylinder walls and other structural area, a bus company is now saving more than $5000 per year in repairing engine blocks and heads. Castings are preheated in an oven to 900 degrees F. for one-half hour to burn out impregnated oil and other impurities. Then they are cooled to 400 degrees F. before being removed for welding.

How to Make Machinable Welds in Cast Iron

IT is now universally accepted that cast-iron parts can be repaired by welding, using the metal-arc process. What is not generally appreciated is the fact that these welds, while strong, can be soft enough to permit machining. In many cases, repair would be useless if the joint could not be machined after welding. Often a surface is involved that must be finished within close tolerances to accommodate a mating part.

The secret to getting machinable welds lies in two factors: proper selection of electrode and correct welding procedure. Use of a mild steel electrode may produce a very strong joint but the deposited metal picks up carbon from the cast iron and creates a hard, brittle alloy that is subject to cracking. For a softer weld, nickel or nickel-iron electrodes should be used. Typical examples of these are Ni-Rod and Ni-Rod "55" electrodes developed by the International Nickel Co., Inc.

The choice between the two electrodes usually depends on several factors. In general, however, welders choose Ni-Rod electrode for general-purpose work with cast iron, particularly where thin sections are involved or machinability is especially important. On the other hand, Ni-Rod "55" electrode is preferred for heavy sections, high-phosphorus irons, ductile iron, Ni-Resist austenitic cast iron, and high-strength cast irons, as well as for joining cast iron to other metals.

A major advantage of nickel and nickel-iron electrodes is that the need for preheating is reduced, if not eliminated entirely, for many applications. This is an important feature where large castings are involved, or where the use of preheat will cause distortion in adjacent members.

The following procedure is recommended for repairing cast iron:

Cleaning—Surfaces must be free from oil, water, rust, and other foreign material. The skin of the casting, which may contain sand and other impurities from the mold, should be ground off. Preheating at temperatures of 400 degrees F. or higher will help remove oil and water.

Joint Preparation—Vee and double-vee type joints having a 60- to 75-degree included angle are generally preferred when using the metal-arc process. For extremely heavy sections, a U or double-U groove with a 10- to 12-degree side angle and 3/16 to 1/4-inch root radius is suggested.

Preheating—While preheating can often be eliminated by using nickel and nickel-iron electrodes, preheating and slow cooling will generally produce a softer heat-affected zone. For best results, the preheat temperature should be

A crack in the bottom of this 14-inch valve housing was repaired quickly and permanently by using nickel-iron electrodes. The job was completed in only eight hours without preheat. After each of the nine passes that were required, the weld was wire-brushed and peened to remove slag and relieve stresses. Following welding, an asbestos blanket was placed over the casting to retard cooling.

from 300 to 600 degrees F. Pressure-tight welds require higher preheats. Using a skip welding technique and multiple passes to distribute the heat more uniformly will, many times, provide an adequate substitute for preheating.

Reduction of Stress—When the weld metal has a different coefficient of thermal expansion than cast iron, residual stress will be present in both the weld and the parent metal after cooling. In most instances, the weld metal can be stretched by peening to reduce stress and minimize distortion. After the slag is removed, each bead should be peened with moderate blows—strong enough to move the metal but not rupture it. A round-nosed or ballpointed peening tool should be used, since a flat or sharp tool is apt to rupture the metal.

Postheating—The cooling time following welding can be lengthened by using insulating blankets to cover the welds or, when practical, by burying the weldment in lime, dry sand, or other insulating material. Post-welding heat-treatments can be used to reduce or eliminate the hard zone adjacent to the weld and thus produce optimum machinability. This is a time-temperature relationship which is governed by the composition of the cast iron, the section thickness involved, and the degree of softening desired.

The use of the annealing bead technique is an easy, practical method of achieving some measure of reduction of the hard zone. This procedure calls for the deposition of an additional weld bead, laid down on previously deposited weld metal. Care must be exercised to insure that the bead does not come in contact with the cast iron. The heat input will reduce the hardness in the zone adjacent to the weld.

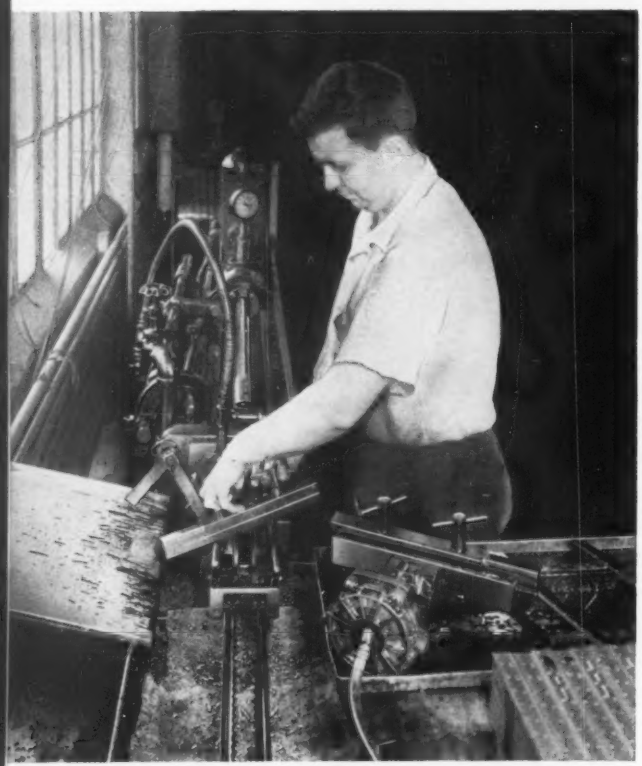
A steel patch welded to this cast-iron dredge pump housing repaired a hole caused by a stone that became lodged inside and broke through the casting. Electrodes of nickel-iron were used because of heavy section and dissimilar metals. No preheating was required. A smaller patch, applied with the same type electrode, repaired a crack in the housing.

Hand Tools Produced by Modern Machine Tools

Like the demand for many other items produced for the home-owner or hobbyist, the market for woodworking hand tools has shown a steady upward trend. To keep abreast of consumer needs, components for these items are manufactured on both standard and specially designed machines that have been tooled to achieve high production rates.

IN the past two decades, manufacturers of carpenter's tools have seen big changes take place in their markets and in their production processes. Whereas artisans formerly purchased most of the hand tools, today more than one-half of them are sold to home craftsmen. At the several plants of a century-old manufacturer of these products—Stanley Tools, Division of the Stanley Works, New Britain, Conn.—toolmakers once gaged heat-treating operations almost by instinct, and many of the machines previously used were crude forerunners of today's modern machine tools.

Cutting the locking groove along one face of blades for combination squares is performed on the Lapointe horizontal broaching machine shown in Fig. 1. Two blades are handled at one time—one being fitted into a channel on either side of a fixture block. The block is then clamped tightly between special jaws of a pneumatically operated vise that is bolted to a table alongside the machine. This is to assure proper contact between the blades and the block. Two lock-screws on top of the fixture block are then tightened and the unit removed from the vise.



As can be seen in the illustration, the operator lowers the fixture block into a block-holder on the broaching machine. The groove, which is 0.085 inch wide, plus or minus 0.005 inch, by 0.050 inch deep, plus or minus 0.002 inch, is cut along both blades by a pair of Continental broaches. By working with two fixture blocks, 200 blades can be handled each hour.

In Fig. 2 can be seen one step in the fabricating of a bit extension on a Taylor-Winfield 20-K.V.A. flash butt-welding machine. The head of the bit extension is held in a fixed clamp that also serves as one electrode. At the right-hand side of the machine, held in a movable electrode-clamp combination, is the body and tang end of the bit extension.

As the abutting surfaces are brought into light contact with each other, the electric circuit is completed. Sufficient current then flows through the parts to cause flashing at the joint. As a result, the contact surfaces are heated to a welding temperature. When this occurs, pressure is applied by the movable member, forcing it against the stationary member and upsetting the joint. After the work has been removed from the machine, a blast from two air jets cleans off the electrodes.

A familiar item to most woodworking enthu-

Fig. 1. A horizontal broaching machine fitted with two broaches is used to cut locking grooves along blades intended for use in combination squares. A fixture block holding one blade on each side is shown being removed from the machine.

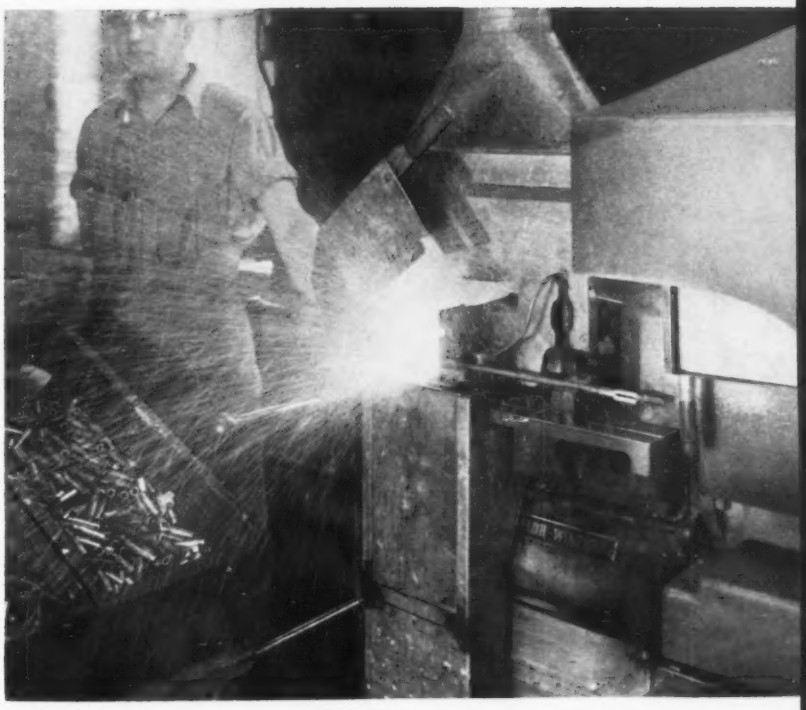


Fig. 2. Bit extensions are fabricated by welding several smaller parts together. Here, a head member is being flash butt-welded to the body of the extension in a fifteen-second cycle. Combination electrode - clamps hold the parts during operation.

siasts is the conventional bit brace. Its ability to function in restricted quarters is made possible by the selective ratchet device located directly behind the chuck. The ratchet members are housed in the fork of the component shown resting on the milling fixture in the lower right-hand corner in Fig. 3.

The fixture, clamped to the table of a Cincinnati Hydromatic milling machine, accommodates two ratchet ends simultaneously. Locating pins position the parts by passing part way into previously drilled holes. The shank end is then secured by a plate that is forced into contact by a cam type clamping lever.

After a rapid advance to the machine arbor, the table feed is reduced automatically to a rate of 1 1/2 inches per minute. The parts are fed into a pair of 6-inch diameter high-speed steel slotting cutters rotating at a speed of 88 R.P.M. Table advance continues until the 0.380-inch wide slot reaches a length of 1.297 inches. Tolerances on the slot width are plus 0.003 minus 0.002 inch; on the slot length, plus 0.000 minus 0.010 inch.

Cutters for bench planes are stamped from strips of high-carbon steel. After blanking, the cutting end is hardened and the entire blade is straightened. The cutter sides are finished on Mattison vertical-spindle surface grinding machines such as the one shown in Fig. 4. Blades are bolted in racks of 125 and are placed, two racks at a time, on a large electromagnetic chuck. The machine table is traversed past a sixteen-segment

Fig. 3. Slots are being milled in the ratchet ends for bit braces. The parts are located and gripped two at a time by a heavy milling fixture which is fed into a pair of high-speed steel cutters.

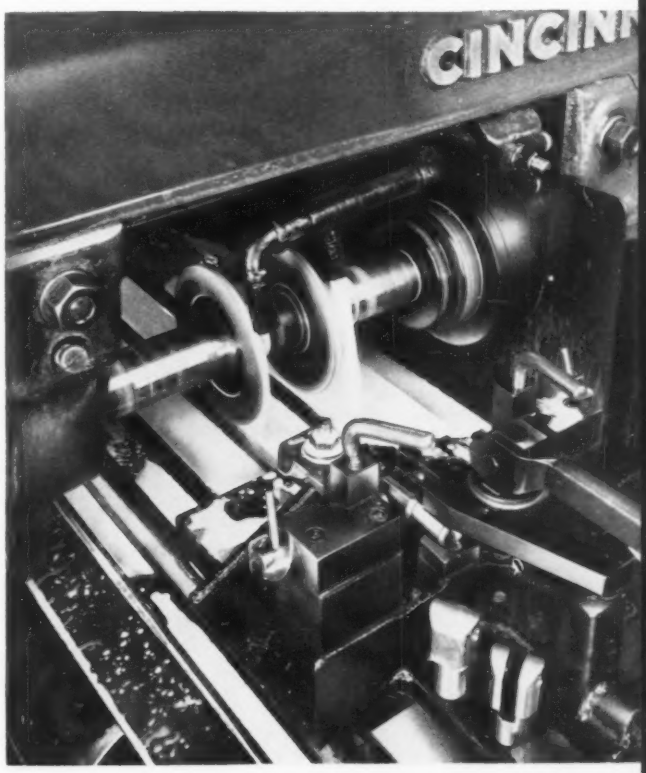


Fig. 4. A sixteen-segment wheel is used to grind the sides of plane irons. Two racks of 125 cutters are held on a magnetic chuck and are finished at the rate of 14,000 per eight-hour day.

Norton Alundum abrasive wheel at a rate of 700 inches per minute. A wheel speed of 1170 R.P.M. is employed.

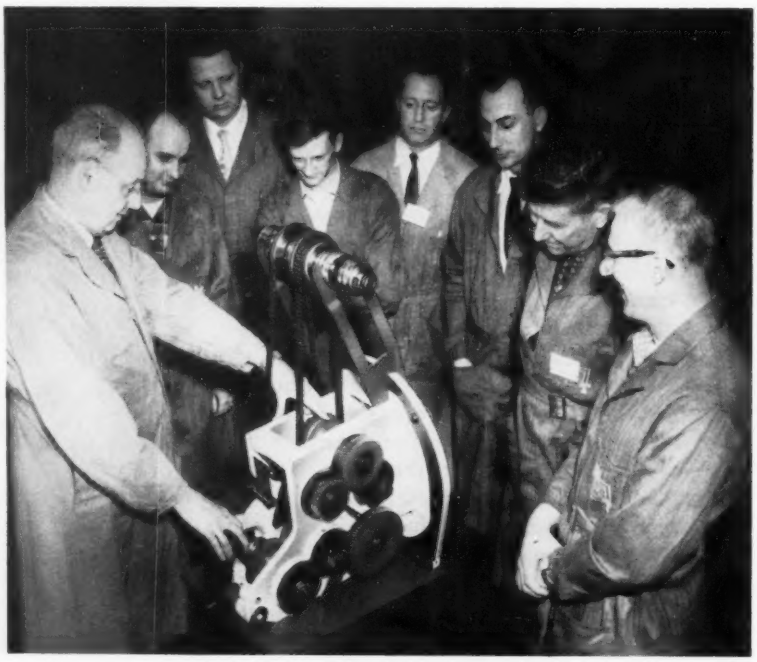
Feed of the wheel-head varies from 0.0015 to 0.0005 inch. When one side of the blades has been finished, the racks are turned over and the operation repeated, resulting in a total metal removal of approximately 0.015 inch. A coolant is used, consisting of a solution of sodium nitrate and borax in water.

* * *

Brown & Sharpe Expands Precision Center Training Facilities

Virtual doubling of the training facilities in its "Precision Center" has been announced by the Brown & Sharpe Mfg. Co., Providence, R. I. Precision Center is a vast training and demonstration facility where designers, machine operators, tooling experts, distributors, and salesmen are taught the latest in tooling and machining techniques. Courses are limited to from eight to thirty members per class—depending upon the subject—and cover such subjects as screw-machine cam and tool design, screw-machine maintenance, grinding techniques, and salesmen training.

Most popular of the courses is the one on screw-machine cam and tool design, covering the selection of spindle speeds and indexing; threading and threading throws; turret positions and cutdowns; and tool design and use of attachments. Experienced instructors refer to a file of 147,000 drawings of cams and tools to help screw machine users maintain trouble-free operation and realize the production potential of their machines. Persons desiring to attend Brown & Sharpe Precision Center training courses can obtain full information by writing to the company.



Assembly of the spindle driving mechanisms for an automatic screw machine is being explained to students of a maintenance course. The Precision Center is equipped with new tools and machines—including the latest No. 2 automatic screw machine.

Profile-Duplicating Slide for Turret Lathes

Article based on a paper which received an award from the Technical Papers Subcommittee of the National Screw Machine Products Association

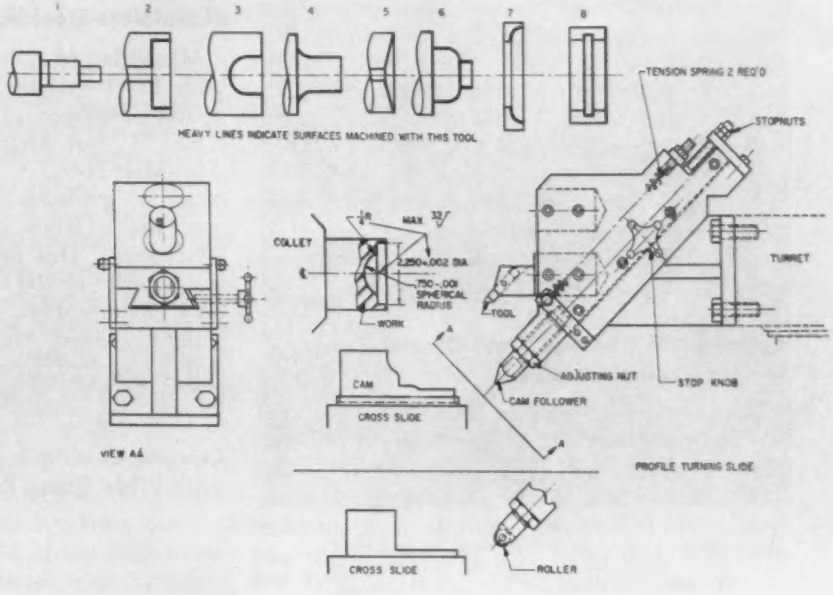
By S. R. ROSEN, Chief Engineer
U. S. Automatic Corporation
Amherst, Ohio

A SLIDE mounted on the turret of a lathe that can follow the profile of a template has been found useful for duplicating certain turning and boring operations. Originally designed to cut a ball seat, the device has since found wide application in the machining of short-run jobs which require both close tolerances and good finishes. The slide and its use are here described.

The upper slide is spring-loaded to keep the follower in contact with an appropriate template (or cam) which is secured in a fixture on the cross-slide of the turret lathe. Stop-nuts limit the downward motion of the slide, follower, and tool which move at an angle of 45 degrees with the lathe center line. Two tool positions are provided.

In using the unit, the tool must start cutting at the bottom of the work-piece and continue until the center is reached. At this point, the slide is locked by the stop-knob and the turret moved away. After the stop-knob is released, the tool is ready for the next cycle. For internal cutting, the tool is set as a regular boring tool, and the template takes the shape of the lower half of the bore. During turning operations, the tool is set as a knee tool, and the template is made to conform with the upper half of the work.

When making internal grooves, the template is simply a vertical surface, and the tool is allowed to back out of the groove by not locking the stop-knob in this case.



Spring-loaded slide follows profile of a template to permit duplication of work. Various templates may be secured in fixture mounted on cross-slide of the turret lathe.

MATERIALS

The properties and new applications of materials used in the mechanical industries

High-Strength Stainless Steel for Structural Applications

A chromium-nickel-manganese stainless steel which is being used for structural members and siding and roofing for railway cars and trailers and some architectural applications has been brought out by the Allegheny Ludlum Steel Corporation, 2020 Oliver Building, Pittsburgh 22, Pa. This steel, called "Type 201," is an austenitic steel with a nominal composition of 17 per cent chromium, 4.5 per cent nickel, and 6 per cent manganese. The corrosion properties are adequate for mildly corrosive media but are not as good as some of the more highly alloyed grades.

This steel is used in the fully annealed condition as well as cold-rolled. In the latter condition, Type 201 develops higher tensile properties than other more stable austenitic grades and for this reason finds a wide field of applications in structural assemblies. In the annealed condition, it has the following physical and mechanical properties: yield strength, 50,000 pounds per square inch; tensile strength, 115,000 pounds per square inch; elongation, 50 per cent in 2 inches; and hardness, 91 on the Rockwell B scale. In the full-hard condition, it exhibits the following properties: yield strength, 148,500 pounds per square inch; tensile strength, 191,600 pounds per square inch; elongation, 9 per cent in 2 inches; and hardness, 44 on the Rockwell C scale.

This steel may be welded by all of the conventional methods applicable to 18 per cent chromium—8 per cent nickel steels and may be fabricated by bending, forming and drawing.

Colored and Textured Vinyl-Coated Metals can be Stamped

Aluminum and steel in attractively textured and colored finishes in gage thicknesses of from 18 to 30 have been announced by the Sun Steel Co., 1702 W. 74th St., Chicago 36, Ill. The material, called "Texkote," consists of a steel- or aluminum-base metal with an integrally bonded vinyl-plastic coating which is 0.002 to 0.020 inch thick. The coating has a high abrasion and electrical resistance and is not affected by heat or humidity. It can be deep-drawn, roll-formed, punched, and can undergo other pressing and stamping operations without damage.

Uses include the manufacture of carrying cases, luggage, appliances, automotive and aircraft trim, and other articles that have simulated wood grain, leather, or linen finishes.

Vacuum-Melted Nickel-Base Alloy that Withstands Loads at High Temperatures

The General Electric Metallurgical Products Department, Detroit 32, Mich., has announced the development of a vacuum-melted nickel-base alloy that is suitable for extended operation under load at temperatures of 1240 degrees F. The alloy, designated "M-252," is being used in the form of forged buckets in the first stage of heavy-duty land gas turbines. It is reported to exhibit high rupture strength, good fatigue strength, and a high resistance to thermal shock.

Hot-Melt Compound Facilitates Machining of Stainless-Steel Honeycomb

Machining of stainless-steel honeycomb structures has been made easy by a hot-melt compound developed at Furane Plastics Inc., 4516 Brazil St., Los Angeles 39, Calif. The material, "Hot-Melt H-883-A," should prove useful to aircraft and guided-missile manufacturers who are now using large quantities of stainless-steel honeycomb. This material, which melts near a temperature of 200 degrees F., provides support, upon solidification, to the honeycomb as it is being machined. After machining, the compound may be melted from the honeycomb, and any residue can be cleaned with hot water.

Ceramic Cutting-Tool Material with Wide Speed Range

A ceramic formulation, called "Ceralox OX-12," which is capable of cutting steel over a wide range of speed without undue wear has been announced by the Adamas Carbide Corporation,

Kenilworth, N. J. This sintered aluminum oxide may glow at red heat when operating as a cutting tip, yet the work-piece remains cool, since most of the heat is being transferred to the chip. Chips do not weld to this material which is highly resistant to cratering.

Phosphatizing Compound for Ferrous and Other Metals

Oakite Products, Inc., 126 Rector St., New York 6, N. Y., has placed on the market a compound which imparts an iron phosphate coating of 80 to 120 milligrams per square foot in metal spray washing machines. The compound, named "Oakite CrysCoat No. 47," removes light oils, grease, spinning compounds, and shop soils and converts the surface of steel and iron into a thin, dense coating that resists corrosion and has good paint-adhesion qualities. Advantages claimed for this compound are: stability in solution despite minor changes in pH; fast rate of coating; low foaming character; and satisfactory cleaning of aluminum, zinc, and brass, as well as ferrous metals.

Long-Lasting and Economical Babbitt Bearing Metals

A series of five babbitt metals made by the Glyco process which are economical and have a long life have been placed on the market by Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago, 80, Ill. These bearing metals have a fine grain structure, low frictional qualities, and retain strength at high operating temperatures. They are free-flowing, unharmed by overheating, free from dross, and re-usable. The five types are as follows:

"Turbo Glyco" (Brinell hardness 30 to 32) is recommended for the most severe applications. It was designed for use in rock-crushing machinery, turbines, rotary pumps, steam engines, and heavy-duty woodworking machinery.

"Marine Glyco" (Brinell hardness 27 to 29) is a heavy-duty bearing metal intended for use where service is severe and a dependable high-grade babbitt metal is necessary. It is used in railway equipment for lining locomotive brasses and cross-head sliders; and used for bearings in steam and gas engines, air compressors, rolling mill engines, reciprocating motors, and similar equipment.

"Standard Glyco" (Brinell hardness, 23.5 to 24.5) is a babbitting material for general machine and repair shop requirements. It is recommended for use in the main-shaft and crank-pin bearings of the smaller sizes of steam engines, air compressors, and pumps.

"Transmission Glyco" (Brinell hardness, 23 to 25) is recommended for use in light machinery and shafting bearings where stresses are unimportant and low cost is a prime consideration.

"Heavy-Pressure Mill Glyco" (Brinell hardness 24 to 26) was developed especially for extra heavy-duty bearings such as those used in steel and cement mills where bearing temperatures are high and pressures are great.

Powdered Brazing Alloy for Production Brazing of Aluminum

A self-fluxing brazing alloy, known as "Handy Alumibraze," for joining many types of aluminum alloys has been made available by Handy & Harman, 82 Fulton St., New York 38, N. Y. This alloy is supplied as a dry powder and applied as an aqueous slurry, after which the part to be brazed is immersed in a molten salt bath. Advantages claimed for this product are as follows: it can be applied conveniently to any surface regardless of contour and will stay put and not flow prematurely.

The alloy is an aluminum-silicon eutectic (88 per cent aluminum, 12 per cent silicon) which carries the American Welding Society's designation BA1Si-4. It melts in the narrow range of from 1070 to 1080 degrees F. and is generally brazed at

This aluminum brazing alloy powder is applied in an aqueous slurry form to aluminum assemblies for subsequent production brazing in molten salt baths.

a temperature of 1100 degrees F. Strength, soundness, and corrosion resistance of joints made with this alloy are at least equal to those made with a solid brazing alloy of the same composition.

Semi-Rigid Vinyl for Laminating to Metal

A semi-rigid vinyl that can be laminated to metal sheets or continuous coils and then formed into products or components has been announced by the Masland Duraleather Co., Philadelphia 34, Pa. After bonding, "Masland Duran Clad," as the material is called, can be processed on standard metal-forming machinery. It can be crimped, bent, drilled, or drawn, just as the metal itself without impairing the textured vinyl. This vinyl is washable and abrasion resistant and is offered in a wide variety of colors.

Aluminum Casting Alloy with High Tensile Strength

A high-strength aluminum casting alloy which is an improvement over existing alloys and may replace forgings in aircraft and other industries has been announced by North American Aviation, Inc., International Airport, Los Angeles 45, Calif. This alloy, called "42B," can be cast in either permanent or sand molds. Parts cast in a sand mold have a minimum tensile strength of 42,000 pounds per square inch, while parts cast in a permanent mold have a tensile strength of over 45,000 pounds per square inch. The alloy can be cast by ordinary foundry methods.

The molder is breaking open a sand mold containing an aircraft part made of 42B aluminum casting alloy, which is being used to produce intricate completely formed aircraft and missile parts.

Leaded Steel Available in Forged, Rolled, or Ingot Form

A leaded steel with machining characteristics that eliminate the need for certain lathe operations and result in low tool wear has been announced by Alco Products, Inc., Box 1065, Schenectady 5, N. Y. This material, called "Hi-Qua-Led Steel," is produced in all steel grades in forged and rolled rings from 18 inches to 145 inches over-all diameter and in ingots up to 50,000 pounds.

In the variety of steel grades that have been made to date, the physical properties of the basic steel remain unchanged and the pattern of lead distribution is unaffected by the grade of steel. In many instances, an acceptable finish is obtained with a roughing tool.

Non-Foaming Cleaner for Removing Markings from Aluminum

A non-foaming cleaner which removes identification inks, greases, oils, and other heavy soils from aluminum has been announced by Oakite Products, 126 Rector St., New York 6, N. Y.

Called "Oakite Aluminum Cleaner No. 164," this material is said to clean without foaming in agitated tanks. It will also remove difficult soils without agitation. The cleaner is used in a ratio of from 6 to 8 ounces per gallon of water at temperatures between 160 and 180 degrees F.

Broader Hardening Range Announced for Specialty Tool Steel

The oil-hardening non-deforming tool steel called "Stentor," manufactured by the Carpenter Steel Co., 101 W. Bern St., Reading, Pa., can now be hardened safely over a broader range of temperature than was previously permissible. The new hardening range, 1425 to 1525 degrees F., has been made possible without changing the analysis of the steel. Physical properties still include freedom from decarburization, minimum size change, uniform hardenability, and no necessary preheating.

Applications include dies for blanking, forming, molding, laminating, and trimming; broaches; collets; stamps; spindles; master taps; and thread gages.

Electric Motors—the Modern Way

A 100,000-square-foot plant addition to the Ashtabula, Ohio, division of the Reliance Electric & Engineering Co. represents a milestone in the electric motor industry. This company, whose products drive a goodly share of industrial equipment, has fittingly incorporated a high degree of automatic manufacturing in its newest facility. In operation since early this year, the plant builds industrial alternating-current motors from 3/4 to 40 H.P.

All components are produced as stock parts, rather than for specific orders, and are then assembled to meet customer requirements. When completed, parts are stored in flow bins adjacent to assembly areas. There are separate racks for every motor modification, assuring maximum flexibility and speed in filling orders.

Transcribing Equipment Consolidates Plant Areas

When a customer order is originated, it is processed to five areas of assembly by the production control department. All of these areas begin work simultaneously, producing subassemblies which eventually meet at a final assembly and finishing area. The heart of the system is a TelAutograph transcriber.

Upon receipt of an order, stator coils are wound, inspected, and delivered by conveyor to a coordinating dispatcher who assembles the core, coils, and insulation, and forwards the entire sub-assembly to the core-winding department. All jobs are processed according to a sequence number. This serves to group the frame sizes and enclosures, to cut down setup time on mechanical equipment.

After winding, joints are brazed, insulated, and sewn, and leads and connections tied. The core is then varnished and baked in an automatic process. While it next is being cleaned, the operator at the varnishing station transcribes the sequence number on the TelAutograph. This message is received by these points: frame storage (heading illustration), end parts storage, start of rotor line, shipping office, and production control desk.

These points, having received an actual record of work that has reached the dip and bake station, are signaled to begin selecting various parts

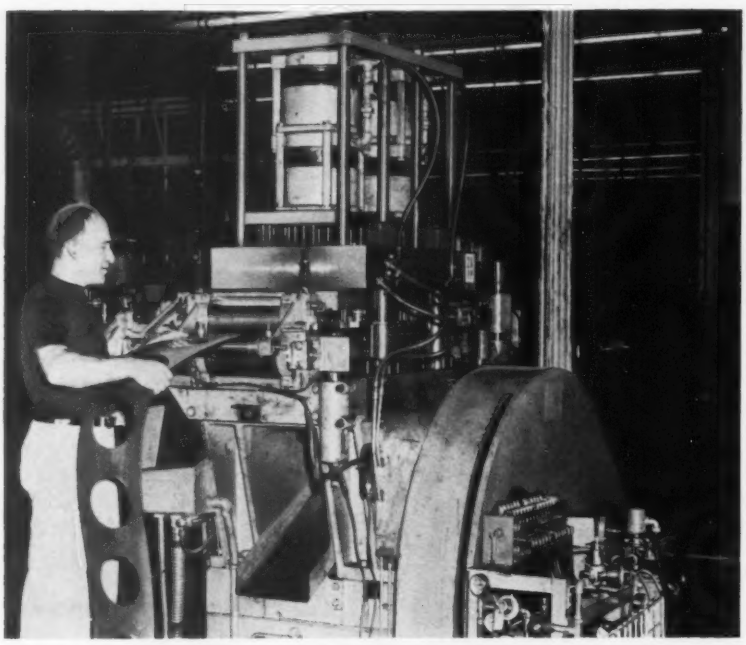


Fig. 1. The rotor laminations have already been punched out, and the coil strip is being fed into the second dieing machine for punching out stators.

from stock and to start building sub-assemblies, so that all parts of the order reach final assembly at the right time. The TelAutograph is located at the varnish station because the time required to finish the stator core balances out with the time required to assemble the rotor and shaft.

At the assembly area, the stator arrives on one pallet, the rotor on another, and end parts on overhead conveyors. The motor is then assembled on a pallet which contains the frame assembly. When assembled, the motor advances to an inspection station, where it is connected to a feed rail line and run in, then given an electrical testing. Reaching the shipping department, the conduit-box cover is assembled, the shaft is protected with a rust preventive, and the exterior painted.

Making the "Cookies" and "Doughnuts"

Rotor and stator laminations are blanked from coils of 3 per cent silicon, 24-gage steel. For high-production lamination requirements, two Henry & Wright 150-ton dieing machines have been installed in tamdem, with the stock progressing continuously through both presses. In the first, the rotor "cooky" is stamped out, Fig. 1, and in the second, the stator "doughnut" is stamped out. Scrap falls onto a vibrating conveyor servicing all machines in the area, and in conjunction with a magnetized vertical conveyor, is carried out of the plant. Laminations used in lesser quantities are blanked out on an open-back inclinable press, then slots are individually punched on small notching presses equipped with automatic indexing fixtures. All stators then head toward the welding department, and rotors, stacked in core lengths, toward the foundry.

At the welding station, the loose stators are grouped by weight and mounted on an arbor which compresses them and aligns the slots in each lamination. The arbor is then loaded onto a flip-over carriage which allows one core to be welded while another is being loaded. Welding is performed with a tungsten electrode in an inert-gas shield, Fig. 2.

The welded stators, now cores, are oxidized and annealed on special alloy pallets not affected by the furnace atmosphere. Meanwhile, rotor laminations stacked in exact coil lengths reach the foundry. There, the stack is skewed on an arbor, and Reliance-designed presses die-cast the cage in either aluminum or Dowmetal. Qualities are improved in a subsequent annealing.

One Transfer Machine for Thirty-Six Frame Types

Biggest single machine-tool investment in the plant is represented by a Sundstrand transfer machine which processes the cast-iron motor frames. The machine has nine operating stations, a load station, an unload station, and a turnover station. Operations include facing, boring, milling, drilling, and tapping. Thirty-six motor frame types can be handled, with production varying from forty-two to seventy work-pieces per hour, depending on frame size.

Frames advance from station to station by a

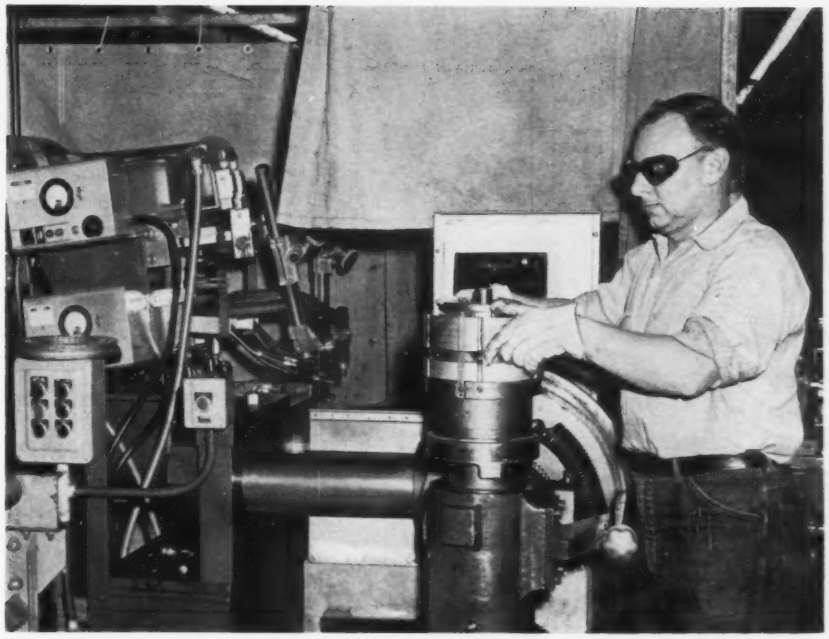


Fig. 2. The operator prepares a stack of stator laminations for automatic welding. At the left can be seen the welder electrodes.

walking beam hydraulic shuttle. As can be seen in Fig. 3, the shuttle has three different fixtures, to correspond to the three diameters of frames handled. When a frame size is changed, the operator simply changes the stroke of the shuttle. Change-overs of tooling are speeded by special accessories, such as colored spacers to position limit-switch dogs. Modern, standard machine tools process twenty-four additional types of frames manufactured at Ashtabula, as well as all end brackets, bearing caps, and shafts.

Quality control provisions have been incorporated in practically every machining step. For example, the transfer machine shuts down automatically when a tool must be changed. Also, in grinding the shafts, a double-contact electric sizing gage takes a constant reading on shaft diameter. Just before the finished diameter is reached, feed rate is reduced automatically, and when the gage is at exact setting, grinding stops.

Each machine-tool operator has a quality control board at his station. An inspection of the operator's work is made regularly, and the findings are charted on his board. Above the board is a red light which goes on when a piece is out of tolerance, signaling the foreman to help the operator regain control. The light also serves as a signal for increased frequency of inspection.

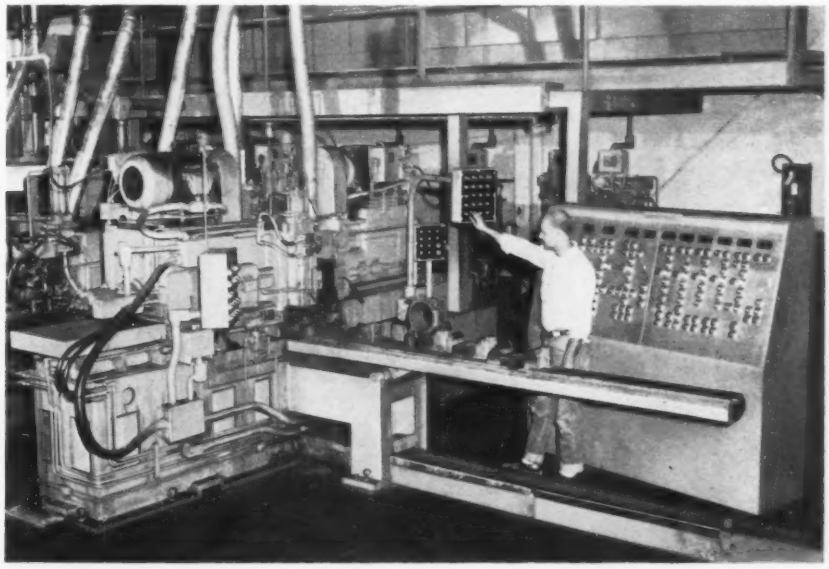


Fig. 3. Three different fixtures are mounted on the shuttle of the transfer machine to accommodate frames of different diameter. Change-overs are accomplished readily, extending transfer machine economy to lots as small as forty pieces.

Jet-engine builder saves material with

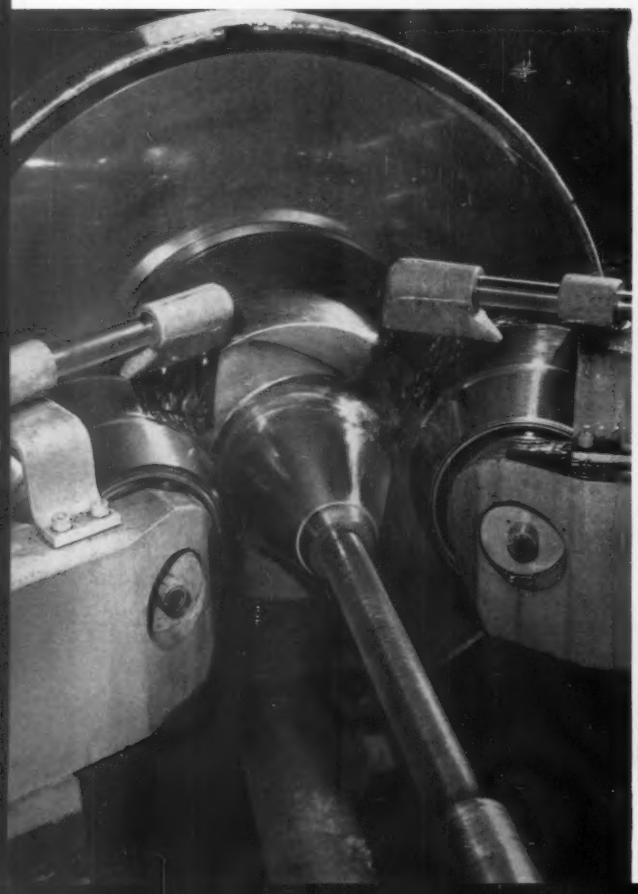
"Chipless" Machining

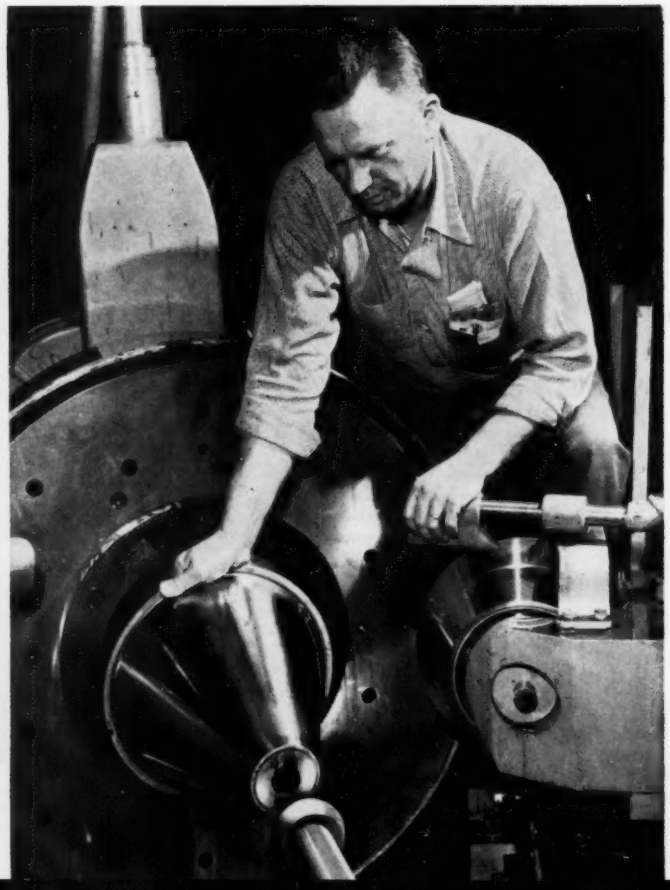
SHAPING of hollow forms by making metal flow, instead of cutting it, is an established manufacturing technique at Pratt & Whitney Aircraft, East Hartford, Conn. Principal economy is the saving of metal—no chips are produced, so there is no waste material.

This "chipless" machining had its inception in the aircraft industry about five years ago, when Claus Sporck brought a Swedish-made stainless-steel cocktail shaker and jigger to Arthur Merry, chief of the company's advanced tool engineering department. Each object was one piece of metal, with a thick base, and without seams or welds. Each utilized all the raw material that went into it.

Although the company had no parts of similar shape in such a small size, Merry immediately

Transformation from flat disc to conical shape on a Cincinnati Hydrospin. (Above) Flow-turning operator sets disc in place. (Below, left) Cone begins to take shape as rollers press forward. Rollers control thickness of metal. (Below, right) Completed cone is removed from mandrel.





saw possibilities—jet-engine compressor cases and conical parts, for example. Sporck subsequently went to work for Lodge & Shipley, Cincinnati, Ohio, machine tool builder, which was commissioned by P & W A to construct a flow-turning machine in line with the shape and size requirements of the aircraft engine industry.

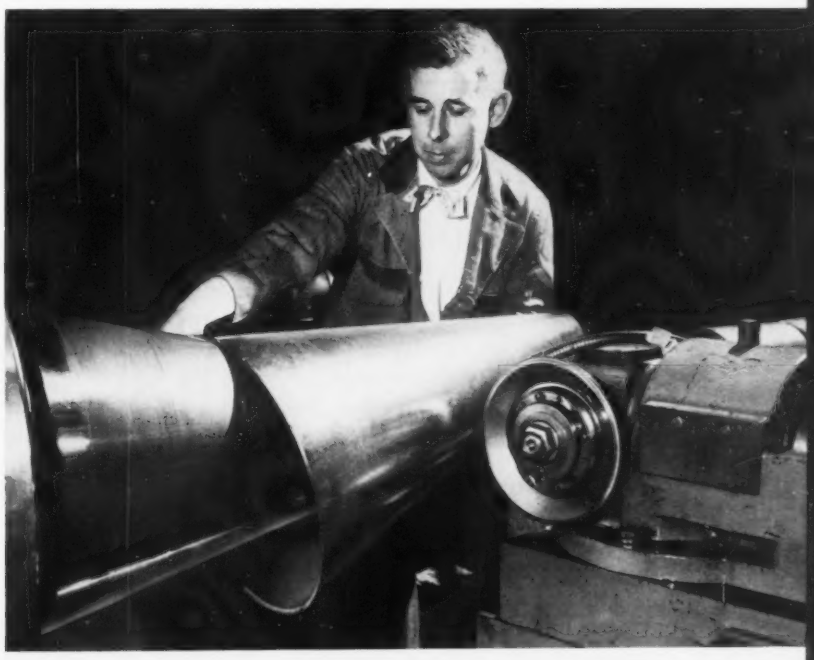
The first three "Floturn" machines arrived in 1953. Experimental work with several parts showed that material saving was substantial; also, the process was fast, and highly uniform parts were obtained. Most parts could be made without welds.

After a period of development, flow-turning was recommended for production parts. Meanwhile, other machine tool builders entered the field. The company obtained a Cincinnati Hydrospin and a special Bullard machine adapted from a Cutmaster vertical turret lathe. In 1956, flow-turning was set up as a separate department at East Hartford.

Six major parts and several small parts are now made in this department. Other parts are now being designed specifically for production by flow-turning.

In principle, the process is similar to that of rolling out sheet metal. Instead of being rolled flat, however, the metal is stretched over a conical or cylindrical mandrel. The machine rotates rapidly, while rollers force the stock over the mandrel. Roller setting controls part thickness. Since the amount of metal needed for a part can be calculated in advance, no metal goes to waste.

Bullard machine being set up for flow-turning a J-57 compressor case. Metal for the case is on top of mandrel. Raw material cylinder, 7 inches high, will stretch to a 16-inch case.



Tool engineer John Campbell—who has been working with flow-turning since company began development—takes cone off mandrel on Lodge & Shipley Floturn machine.

MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Accuracy of Numerical Computations—3

(*Continued from March Issue*)

Division. It might be supposed that in division, the error of the quotient would be less than that of either the dividend or the divisor, but such is not the case. As in multiplication, the error in the answer may be much greater than that in either of the factors.

General Rules for Addition, Subtraction, Multiplication, and Division

Where extremely accurate results are not required, the following rule may be used as a guide in addition and subtraction: Express the answer to as many decimal places as the least accurate figure being added.

In multiplication and division, express the answer to one less decimal place than the least accurate of the figures used. In other words, if an answer to three decimal places is desired in an operation requiring multiplication or division, the factors that are used should be accurate to at least four decimal places.

Other Sources of Calculation Errors

For extreme accuracy in computations, a study of books in which equations and rules for the probable error in various types of computations are derived will be found invaluable. Some of the important facts revealed by such a study are:

Subtractions. The greatest single source of inaccuracy in computations is the loss of significant figures in the subtraction of two numbers that are nearly equal. For example, if the numbers 1234.5 and 1233.4 are each correct to not more than five figures, their difference, 1.1, is correct only to two figures, and the second figure may even be in error by one unit.

Logarithms. An error in a logarithm can cause a much greater error in the anti-logarithm or number corresponding to the logarithm; the error in the number will be 2.3026 times the product of the number and the error in the logarithm. For example, the logarithm of 6.7880 is 0.83174, while the logarithm of 6.7883 is 0.83176. In other words, a change of only 0.00002 in the logarithm has produced a change of 0.00030 in the number itself. This could have been predicted by the formula:

$$\text{Error in number} = 2.3026 \times 6.7880 \times 0.00002$$
$$= 0.00031$$

Sines. An error in calculating the sine of an Angle A can produce a corresponding error in the angle, in degrees, amounting to:

$$57.3 \times \sec A \times \text{error in } \sin A$$

As an example, consider that the sine of angle A has been computed as 0.996195, whereas the true value is 0.996220. These values correspond to angles of 85° and 85° 1′, respectively, in a table of trigonometric functions. Thus, an error of 0.000025 in the sine has produced an error of 1 minute, or 0.0167 degree, in the angle. This could have been predicted from the error formula:

$$57.3 \times \sec 85^\circ \times 0.000025$$
$$= 57.3 \times 11.474 \times 0.000025$$
$$= 0.016 \text{ degree}$$
$$= 58 \text{ seconds}$$

Cosines. For cosines, an error in the function can result in an angular error, in degrees, amounting to:

$$57.3 \times \csc A \times \text{error in } \cos A$$

For example, corresponding to an error of 0.00005 in the cosine of 20° the angular error is:

$$5.73 \times \csc 20^\circ \times 0.00005$$
$$= 57.3 \times 2.9238 \times 0.00005$$
$$= 0.00838 \text{ degree or } 30 \text{ seconds}$$

Tangents. For tangents, an error in the function can produce an angular error, in degrees, amounting to:

$$57.3 \times \cos^2 A \times \text{error in } \tan A$$

For angles in the neighborhood of 20°, if the tangent is in error by 0.00005 the angle as determined from a table could be in error by

$$57.3 \times (0.93969)^2 \times 0.00005$$
$$= 0.0025 \text{ degree or 9 minutes}$$

Finding Angles from Trigonometric Tables. Comparison of the error formulas for sines, cosines, and tangents will show that an angle can be determined more accurately from its tangent or cotangent than from its sine or cosine, since the factor $\cos^2 A$ in the tangent error formula is always less than either the sec A factor in the sine error formula or the csc A factor in the cosine error formula.

That angles may not be as accurately or easily determined from calculated values of sine and cosine as from values of the tangent if errors in these functions exist can be demonstrated in various ways. The simplest way is to examine a table of trigonometric functions to determine which function has the greatest difference between successive tabular values; the function for which the difference is greatest will be least affected by rounding errors and also will be easiest to accurately interpolate. For example, using a five-place trigonometric table, in going from 36° to 36° 1′ the sine changes by 0.00024, the cosine by 0.00017, and the tangent by 0.00045. Thus, the tangent should be used as a first choice in determining angles near 36°, and the sine would be a second choice.

Further examination of the table would reveal that the tangent will always be the most suitable, the sine will be next best for angles below 45°, while the cosine is next best for angles from 45° to 90°.

It should not be inferred from what has been said that only the tangent should ever be used to determine an angle. The point to keep in mind is that *if* there is an error of the same magnitude in the three functions and *if* the angle must be determined as accurately as possible from these three values, then the order of preference applies. An example of where the use of a sine that was somewhat in error produced an angular error which could have been avoided by using the cosine appeared in the April 1956 (page 214) Problem Clinic.

Absolute and Relative Errors

So far in this discussion, the errors that have been considered are of the type called *absolute errors*. The absolute error of a measurement, number, or calculation may be defined as the difference between the exact value and its approximate value as given or determined by measurements or calculation. For example, if in boring two holes 4.0000 inches apart the operator made them 3.9995 inches apart, the absolute error in center distance would be $4.0000 - 3.9995 = 0.0005$ inch.

In producing a manufactured part to some physical dimension, the tolerance specified on that dimension represents the largest allowable absolute error; ordinarily, therefore, it would seem from this and similar cases that we tend to think in terms of absolute errors.

A second kind of error, and one which is actually of even greater importance in discussions of *accuracy*, is what is known as *relative error*. By definition, the *relative error* of a measurement, calculation, or any given value is obtained by dividing the absolute error by the true value of the quantity involved:

$$\text{Relative Error} = \text{Absolute Error} \div \text{True Value}$$

There are practical reasons for considering relative errors instead of absolute errors when talking about the accuracy of results or in comparing them with other results. For example, getting back to the 4.0000-inch center distance holes, the absolute error in their location was 0.0005 inch. The *relative error* would be $0.0005 \div 4.000 = 0.000125$. (Note that relative error is not expressed in any unit of measurement, whereas absolute error is expressed in terms of the unit used.)

Now suppose these holes were to have a center distance of 80 inches instead of 4 inches. Would it be reasonable to expect that the 80-inch dimension could as easily be produced within 0.0005 inch as the 4-inch center distance? Hardly so; but we could expect to produce the 80-inch dimension within the same *relative error* of 0.000125 as the 4-inch dimension. The *absolute error* for the 80-inch dimension could then be as much as:

$$\text{Absolute Error} = \text{True Value} \times \text{Relative Error}$$
$$= 80.0000 \times 0.000125$$
$$= 0.0100 \text{ inch}$$

and still be on the same order of accuracy as the 4-inch dimension which came out 3.9995 inches.

This discussion of absolute versus relative errors can be summarized as follows:

The number of *significant figures* used to express a result is an indication of the accuracy of the result, not the number of decimals used. The true index of accuracy, therefore, is the *relative error* and not the absolute error.

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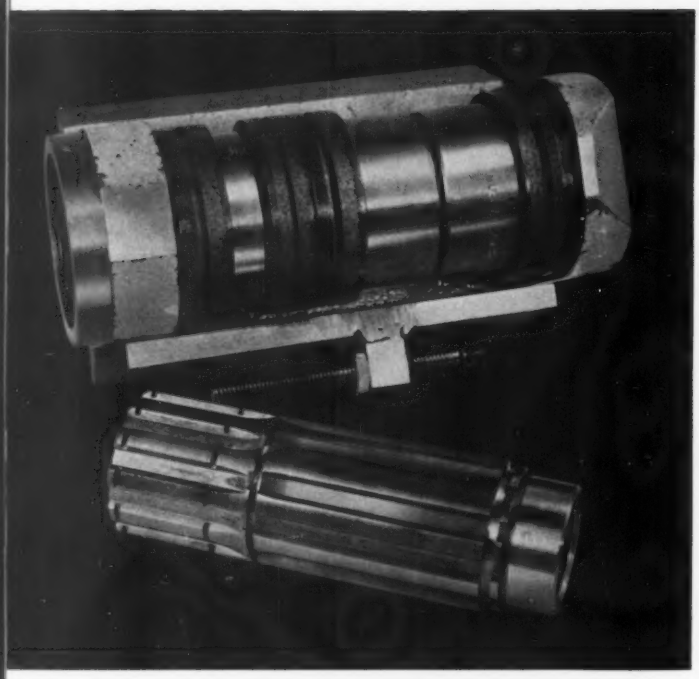

Powder Metallurgy's Latest Triumph

No TIME-OUT for WHEEL TRUING

THE last drawback to a completely efficient form-grinding cycle—non-productive time-out for wheel truing—has now been removed.

While automatic loading, gaging, and wheel-compensating devices have in recent years raised the productivity of the form-grinding machine, it has never been possible to approach 100 per cent efficiency of operation because of frequent interruptions necessary to true the wheel as it wears. This truing has been performed by one of two methods: (1) using a single-point diamond tool directed from a template of the required form, or (2) using an iron, steel, or carbide form roll which is crushed into the wheel periphery.

Now, a third method is available. It is a joint development of the Jones & Lamson Machine Co., Springfield, Vt., and the Koebel Diamond Tool Co., Detroit, Mich. The truing tool is a circular form cutter of diamond particles suspended in a powder-metal body. Rotated in continuous or intermittent contact with the abrasive wheel, the tool operates entirely automatically, neither interrupting the grinding cycle nor requiring any attention by the operator.

In Fig. 1 can be seen the relationship of the truing tool and abrasive wheel. This is a close-up view over the bed of a J & L 6- by 36-inch thread grinder. The wheel form is a half-sphere, and produces a helical track for ball bearings in an automotive steering shaft. In this instance, tool and wheel are in continuous contact. The tool is motor-driven, rotating in an opposite direction to that of the wheel and traveling somewhat faster (up to 500 surface feet per minute higher).

Fig. 1. As the form cutter rotates in contact with the abrasive wheel, thousands of fine diamond particles embedded in the metal powder of the cutter true the wheel periphery.

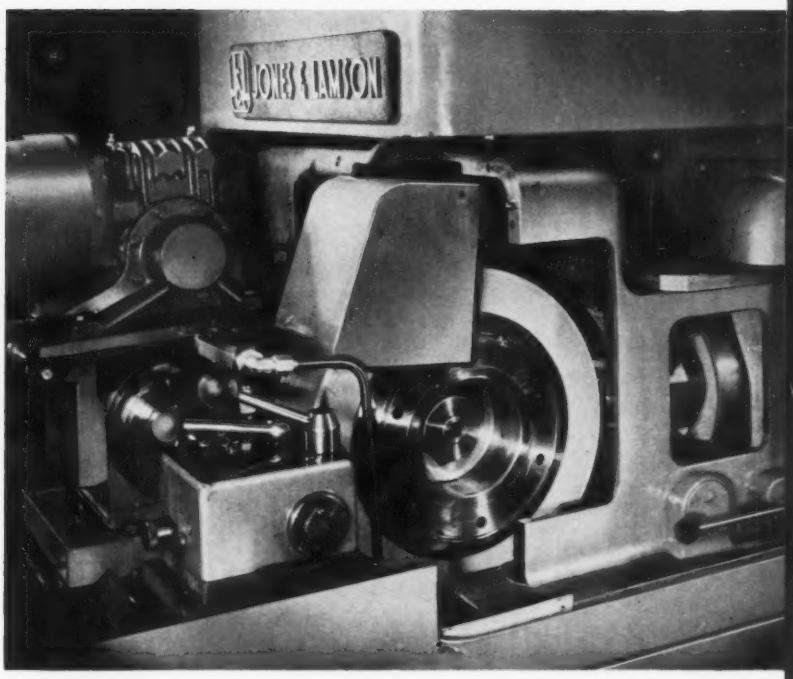

Fig. 2. The work-piece is in front of the abrasive-wheel spindle, the truing mechanism behind it. Form cutters can be in intermittent contact with the abrasive wheel, as here, or in continuous contact, in fully automated applications, as in Fig. 1.

During the grinding cycle, a sulphur-base coolant is applied at relatively high pressure (approximately 25 pounds per square inch). At intervals, the truing mechanism, supported above the abrasive-wheel spindle, feeds downward a small amount to maintain contact with the wheel periphery which, through wear, decreases in diameter. Also, the rate and frequency of wheel infeed to the work is adjusted to balance or slightly exceed the amount of its wear as grinding progresses.

In Fig. 2 is shown a J & L Model E form grinder, set up for producing four snap-ring grooves in a hardened steel splined shaft. The roll assembly and a finished work-piece can be seen in the heading illustration. There is a separate abrasive wheel for each groove, and each wheel, in turn, is trued by a group of three cutters—a central cutter which controls groove depth, between two other cutters which control groove width. Although this is a multiple arrangement, all wheels are trued simultaneously. The working diamond surfaces of the cutters interlock, with spacing shims located between them to permit any needed adjustment for groove width.

Here, the truing mechanism is located behind the abrasive-wheel spindle, Fig. 3, and moves in for intermittent contact with the wheels when truing is required. The grooves produced range from 0.069 to 0.135 inch in width and from 1/8 to 1/4 inch in depth.

Basic truing mechanism, Fig. 4, is a large drum, with a roll arbor at its "business end" powered through a self-contained motorized

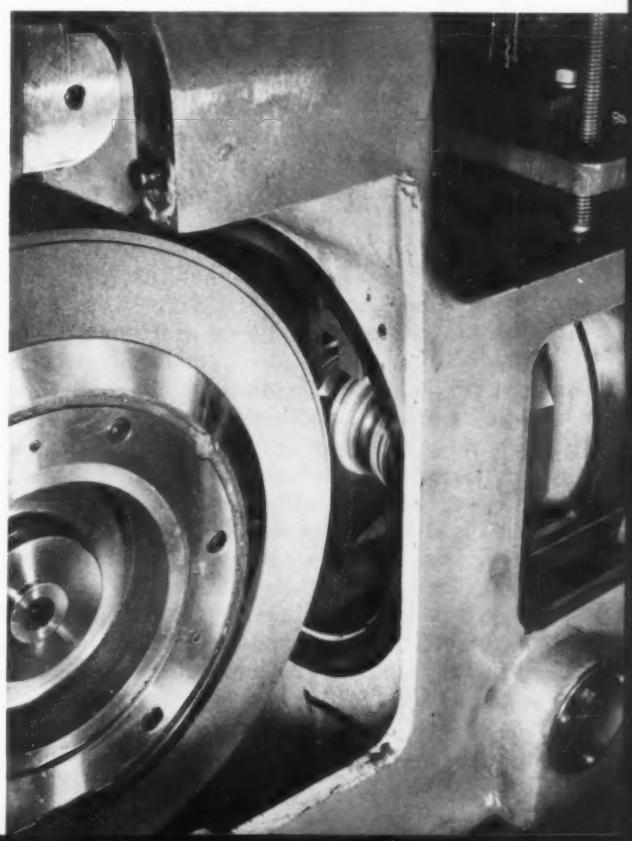

Fig. 3. Close-up view of area behind the abrasive-wheel spindle. Truing mechanism advances cutters hydraulically and compensates for decreasing diameter of abrasive wheel.

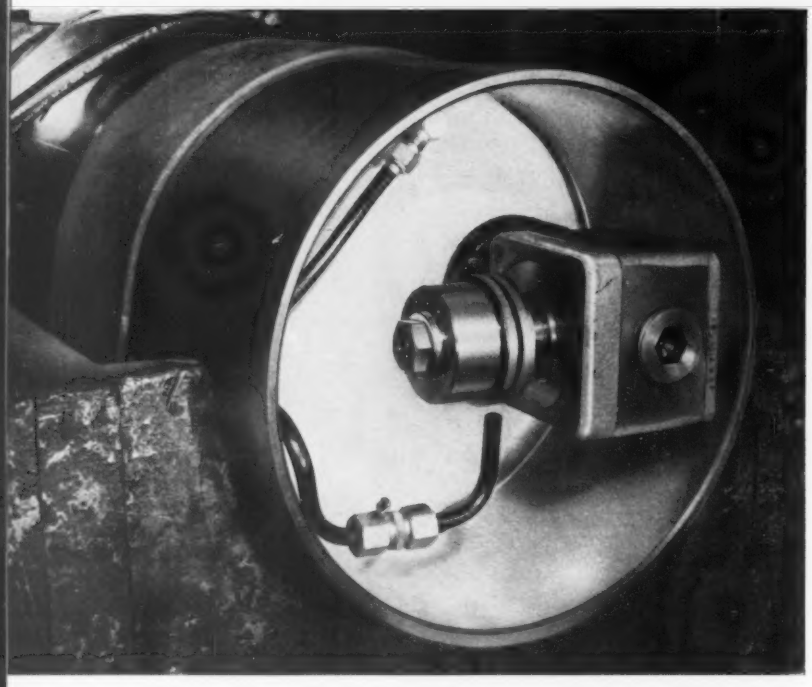

Fig. 4. Cutter group on motorized arbor at inner end of truing mechanism. Piping is for coolant. Entire drum feeds hydraulically to abrasive wheel.

gear-box. When truing is required, the motor is energized, and the arbor moves hydraulically toward the abrasive-wheel spindle.

In addition to eliminating time-out for truing, the use of a diamond-particle roll cutter has other advantages not offered by the traditional wheel-truing methods. With a single-point diamond, the wheel form is obtained by pushing off the abrasive grit. Eventually, the edge of the diamond will grow dull, and the diamond has to be reset in its holder, or the holder shifted, in order to put a new facet of the diamond to work. On the other hand, where there are a multitude of fine diamond particles, the abrasive grit is cut off, not pushed off, and many points, not a single point, share the load of wheel truing. And as particles become worn and dull, they are automatically dislodged and washed away and fresh particles are exposed.

Again, where a wheel is crush-trued, the form roll used is forced into it under tremendous pressure, creating the form by fracturing the wheel periphery. With the new method, however, the pressures on the wheel and wheel-spindle are insignificant.

Koebel's "CDP" (Cemented Diamond Particles) cutters are formed and sintered around a steel core. Depth of case is from 1/32 to 1/16 inch. They are precision items, and to date have shown no appreciable wear after thousands of truing cycles. The cutters have the advantage of using diamonds in their most economical form—as a powder.

Abrasive Machine Tool Co. Observes Fortieth Anniversary

The surface grinding machine that spurred the founding of the Abrasive Machine Tool Co., East Providence, R. I., is on permanent exhibition at the Smithsonian Institution in Washington, D. C. Built in 1916, it was the first machine of its kind to utilize a solid one-piece cast frame with the motor mounted on the inside of the machine.

In 1917, with 6000 square feet of floor space and eight employes, the company was chartered on its present site. Today it covers 65,000 square feet of floor space, employs more than 150 people, and has sales offices throughout the United States.

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Publication Lists Available Films

A 24-page booklet, published by the National Machine Tool Builders' Association, lists 123 motion picture films on machine tools and machining operations. Produced for sales or training purposes, these films are concerned with specific machining operations. A few, however, are devoted to telling the story of the part played by machine tools in industry. They are available without charge upon request to the releasing company. Copies of the publication entitled "Motion Pictures Available from Members" can be obtained by writing to the National Machine Tool Builders' Association, 2071 E. 102nd St., Cleveland 6, Ohio.

MACHINERY'S

Reference Section

By E. N. FIELD

Greater efficiency is possible with

AUTOMATIC MATERIAL-HANDLING FOR THE DIE-CASTER

There is still one step in the almost fully automatic die-casting cycle that has remained practically unchanged. In the face of great strides in the development of machines and techniques for improving the quality and efficiency of the process, the fact remains that work removal from between the dies is usually a manual process. Although there are times when this is desirable, in many cases removal and transfer can be automated.

VIRTUALLY all die-casting machines now being manufactured are provided with power-actuated die movements, hydraulic or pneumatic injection, and some mechanical means of core-drawing. Yet the removal of castings from the die is still performed, almost invariably, by hand. In this respect, die-casting differs from the majority of mass-production processes in which removal of the work from the tool is a primary consideration of designers.

There have been good reasons, however, for retaining manual work removal in the die-casting cycle despite the fact that this has precluded development of completely automatic machines. One reason is that there may be considerable variations in size between sprays of castings—even though the actual castings are dimensionally identical—due to different spreads of flash. It is difficult to devise guides and gripping members to handle these untrimmed castings effectively.

An allied factor, which more than any other has held back the successful operation of fully automatic die-casting machines, is the tendency for detached particles of flash to remain between

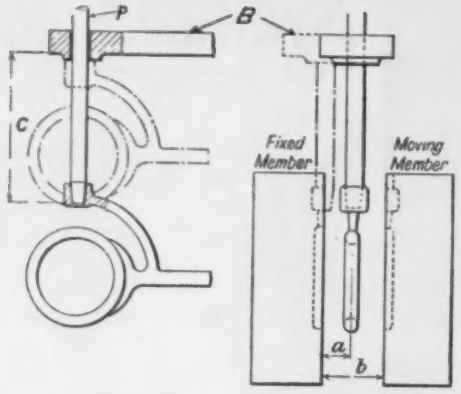


Fig. 1. After injection, transfer pin (P) moves through distance (a), which is half the distance (b) traveled by the moving die member. The transfer pin is elevated and the casting stripped off against a fixed bracket.

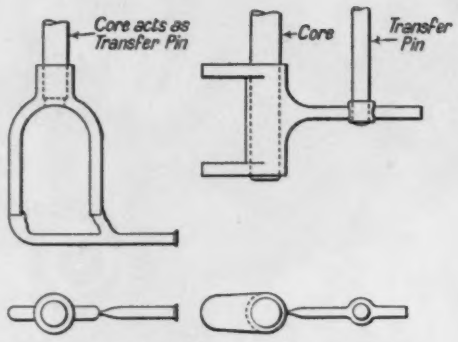
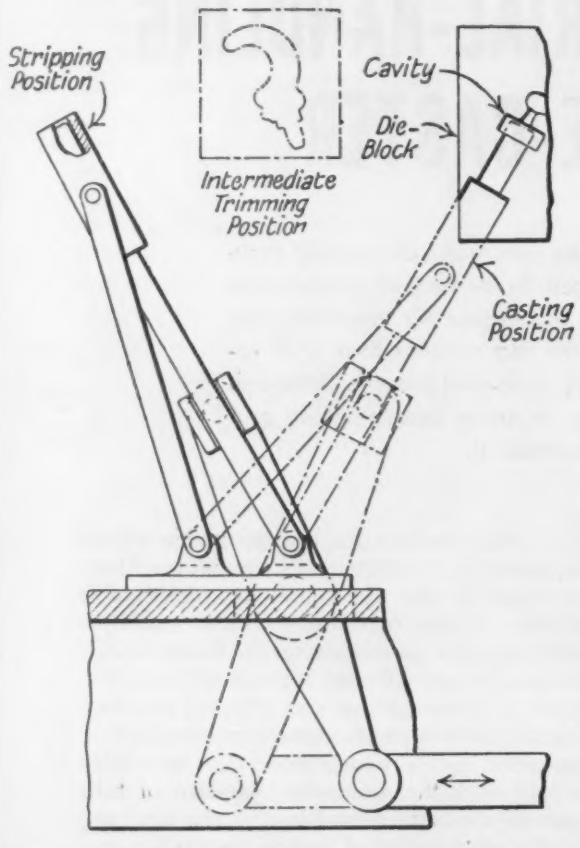


Fig. 2. It is desirable, if possible, to make use of a core as a transfer medium. The core can be used either alone as a transfer pin (left) or can be used in conjunction with a pin that engages the runner (right).



the dies after the casting has been removed. If not cleared away, these particles prevent complete closure of the die members during the next cycle of operation. It is advisable, therefore, that the operator inspect the die faces before each closure.

Manual work removal thus serves as a safety measure, since it provides an opportunity for checking the condition of the die faces after each cycle. Moreover, it permits immediate visual inspection of the work produced, so that minor errors that do not affect the mechanical operation of the tool—such as displacement of small fixed cores—can be detected before any quantity of faulty castings has been made.

It is only in recent years that commercial die-casting machines have been fitted with the necessary controls and timing devices to make fully automatic operation practical. However, wider application of automatic operation may be slowed down by the increasing use of cold-chamber machines, with which ladling of the charge imposes a definite break in the cycle. Even when there is no possibility of making production completely automatic, it still may be advantageous to eliminate manual work removal. It is in connection

Fig. 3. The casting is removed from the die by a swinging transfer arm. Trimming takes place at an intermediate position, and the runner alone is stripped from the arm at the third position.

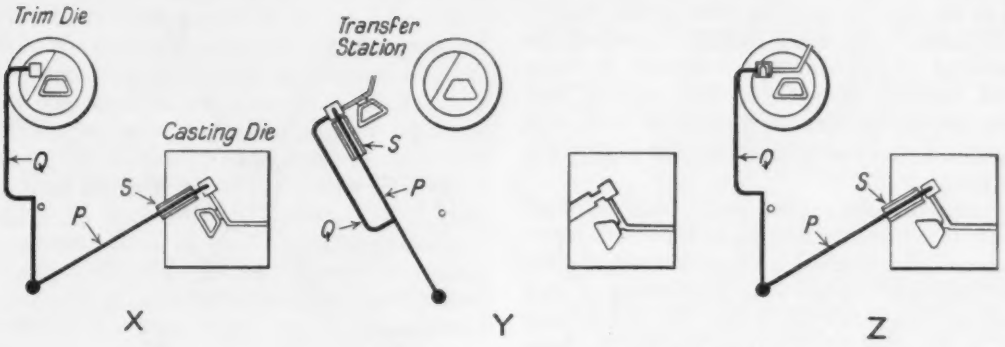


Fig. 4. Double-arm arrangement shown permits trimming and stripping of the casting without interrupting the movement of swinging rod (P). A spring clip on transfer arm (Q) removes the casting from rod (P) and aligns it with the trimming die.

with large machines, operating on relatively slow cycles, that recent examples of unloading devices have proved most effective.

Automatic Transfer Methods

Although a large number of automatic transfer or unloading methods have been applied to die-casting machines during the past fifty years, all of them conform to one of these five basic types:

1. A moving finger detaches the casting from the ejectors, the casting falling away by gravity.
2. The casting, or a portion of the runner, is formed around a transfer pin that is movable with respect to the die. At a subsequent release station, the casting is stripped from the pin.
3. A pair of gripping jaws is advanced into the open die to engage the casting and detach it from the ejectors.
4. A casting, or spray of castings, is formed in partial engagement with the previous spray to form a solid strip that can be moved by a mechanism external to the die.
5. An unloading fixture is advanced into the open die to receive the casting at ejection.

The first group includes what is almost certainly the initial method of automatic work removal. A swinging arm pivots down and engages the sprue, pushing the casting off the die face and permitting it to fall free. Aside from this example, there are few successful removal methods in the first group.

Function of Transfer Pins

Group No. 2, by contrast, embraces a large number of the most effective methods being used. One of the simplest is shown in Fig. 1, where a cup-like extension of the runner is cast around the tip of transfer pin *P*. The pin is coupled to a small core-drawing cylinder mounted on a bracket, overhanging the die.

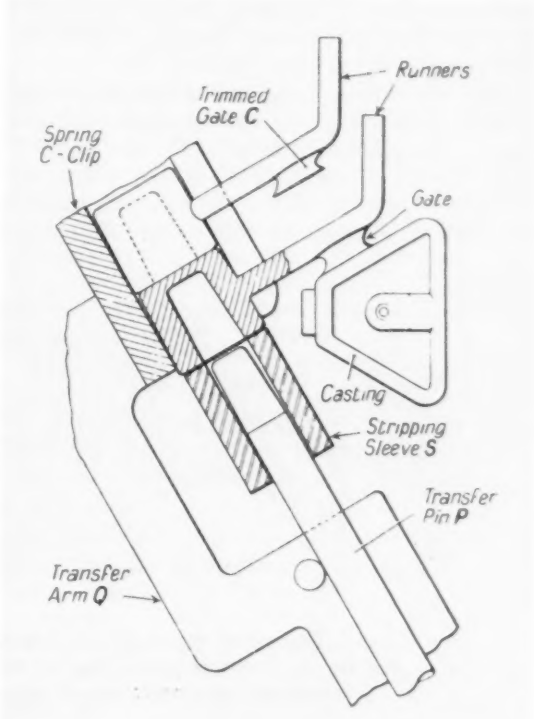


Fig. 5. Details of the stripping sleeve and clip used with the device illustrated in Fig. 4. In operation, the spring clip contains several runners such as the one shown above the untrimmed casting.

When the die is opened, the casting remains fixed to the transfer pin. As soon as the pin has moved through distance *a* (which is one-half the travel *b* of the moving die member), it is retracted through distance *c*. The casting then strikes the under side of bracket *B* and it is stripped off the end of the transfer pin at the same time.

Provided that the impressions in both die members are free from under-cuts and are sufficiently chamfered, this method is very effective. On the other hand, any tendency for the casting to stick in the die, especially when the tool is hot, may result in the work being either bent out of shape or torn apart. It is desirable, therefore, to utilize a core as a transfer pin either alone (Fig. 2, left) or in conjunction with a pin engaging the runner (Fig. 2, right). A modification of this last method that can be used with lightly gated components consists of moving the two pins successively instead of simultaneously. The advantage is that the runner will be broken away from the casting before stripping occurs.

Instead of retracting the transfer pin through a relatively fixed stripping plate (Fig. 1) and allowing the work to fall from the tool by gravity, it may be desirable to provide a pivoting transfer pin upon which rides a sleeve-like stripper. This arrangement, Fig. 3, makes it possible to swing the casting clear of the tool before stripping takes place. A trimming die can be located at an intermediate position, the runner alone being subsequently stripped from the pin.

Although it is generally advantageous to trim castings while they are still engaged with the transfer pin, methods similar to the one just outlined have an inherent drawback—the casting cycle must be arrested during the time the transfer pin is out of engagement with the die. It is preferable to strip the casting from the pin prior to trimming so that it can be returned to the casting position immediately. The die can then be made to close simultaneously with the operation of the trimming die.

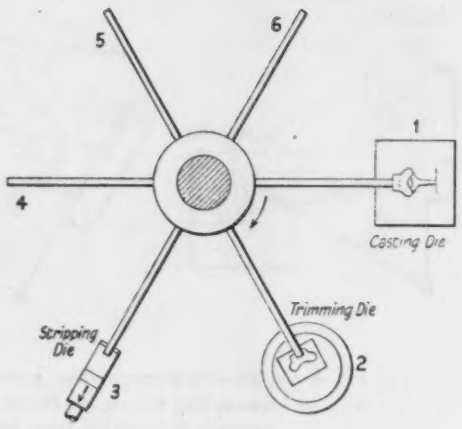


Fig. 6. A turret wheel system of transferring castings from the die to several subsequent positions where secondary operations such as trimming and stripping are performed. The end of a transfer pin protrudes into the die and the molten metal is cast around it.

A simplified diagram showing how this can be accomplished can be seen in Fig. 4. Swinging rod *P*, the end of which is cast with the runner, pivots to the left, where it contacts spring-loaded transfer arm *Q*. At the upper end of the transfer arm is a C-shaped spring clip. When the two pivoting arms come into contact, they move in unison, as shown at Y. During this movement, the casting is

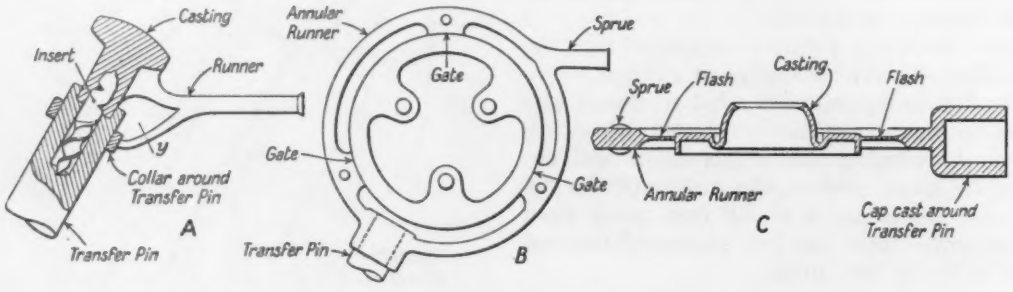


Fig. 7. The end of the turret-wheel transfer pins can be drilled to locate inserts in the die (A). For rigid positioning, a branch-runner and a collar should be provided. Supplementary runners may be necessary on some castings, as at B and C.

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stripped from the end of rod *P* by sleeve *S* and is forced into the clip on arm *Q*.

When the casting has cleared the swinging rod *P*, it swings back into position between the die-blocks. The transfer arm also moves back, but is arrested when the casting is aligned with the trimming die, as illustrated at Z. As the die members close for the next cycle, the casting is trimmed. In operation, the C-clip, Fig. 5, contains several runners from castings previously trimmed. Only the lowest runner is tightly gripped, and at each cycle the uppermost runner is discharged as the swinging arm reaches the end of its stroke.

Turret-Wheel Transfer System

Transfer pins of the swinging-arm type do not have as wide an operational scope as pins having undirectional angular motion. Normally, such an arrangement takes the form of a turret wheel similar to the one illustrated in Fig. 6. Although it is possible to perform an operation on the casting at each of the six stations, only trimming and stripping are being carried out at the second and third positions.

Stripping sleeves (Fig. 3) can be fitted to turret-wheel devices for inter-station stripping, but it is simpler to remove the casting at one of the stations. In this case, a slotted yoke is used into which the transfer pin can enter. When movement of the wheel has been arrested, the yoke is moved downward to strip the die-cast collar from the pin.

Another advantage of the turret-wheel transfer method is that small, internally threaded caps can be cast on the ends of the transfer pins. After being trimmed, the caps may be removed at another station by an electric nut-runner.

The turret wheel can be used for automatic insert location, particularly in the plane of the die parting. It is not advisable, however, to rely on the insert housing in the end of the transfer pin as the sole means of casting location at subsequent operations. Accurate location can be obtained by casting a branch runner, terminating in a collar that surrounds the transfer pin as shown at A in Fig. 7, so that the work is positioned rigidly until the trimming operation has been carried out. The branch-runner is then sheared at any appropriate point (for example, at *y*) and the remaining portion stripped from the pin at a separate station.

Correct positioning and rigid location are of great importance when several secondary operations are to be performed prior to trimming. It may be necessary to add supplementary runners or overflows, as can be seen at B in Fig. 7, to obtain a rigid unit. In extreme instances, as at C, where the component is too fragile to permit heavy gating, an annular runner extends completely around the casting and engages the transfer pin. This runner is joined to the casting by a thin, unbroken flash sheet.

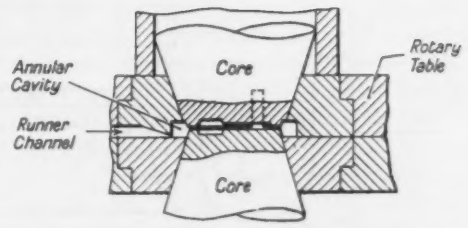


Fig. 8. Sectional view of the die elements that form the mold cavity on a dial-feed type of self-contained die-casting machine. An annular recess that surrounds the two cores connects with the runner channel.

Die-Casting Machine Built Around Dial-Feed Table

A dial-feed table having bushed holes replaces the turret wheel in one model of self-contained die-casting machine. The table is indexed to bring each hole, in turn, into line with the die members at the initial station—one die member, or core, being located below and one above the table, as shown in Fig. 8. They are shaped to form, together with the bushed orifice in the table, an annular recess connecting with the runner channel on the left. The cavity proper is formed between the core faces which, when advanced, do not quite abut.

As a consequence, the casting is formed in a flash sheet that is held rigid by the surrounding annulus. When the cores are withdrawn, the casting is carried to the next station. The machine provides for forming and drilling operations prior to trimming.

In Fig. 9 can be seen a unidirectional type of carrier employing an endless flexible steel band that passes between the die-blocks of a die-casting machine. The band has punched openings of constant pitch and is clamped between the die-blocks. On injection, a slug is formed that engages the edges of the band and carries the casting in the center of a flash sheet.

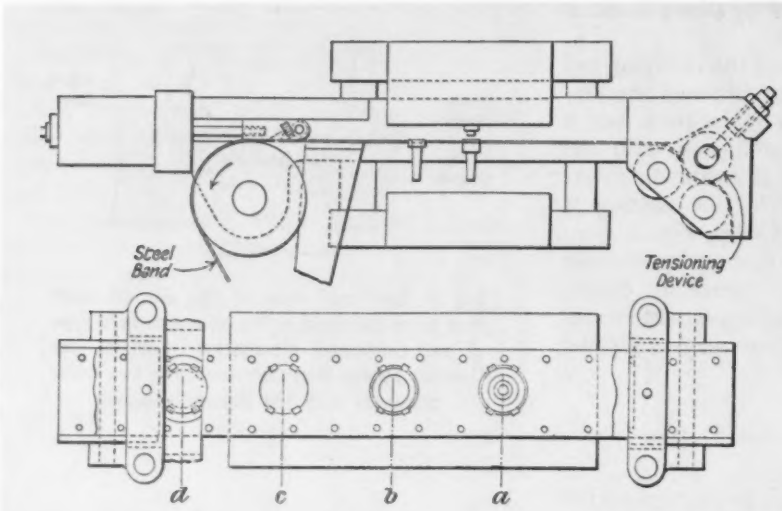


Fig. 9. In this setup, parts are cast in engagement with a flexible steel band at (a). The sprue is sheared at (b), the casting trimmed at (c), and the waste metal removed from band at (d).

Gripping Devices for Removing Castings

Another method for removing castings from the die makes use of gripping mechanisms that are advanced between the die members to engage either the sprue or the casting proper. This basic method has been the subject of much experiment but, unfortunately, with little tangible result. Although replacement of the manual method by a mechanical device appears to be a logical and direct approach, it is seldom successful. One reason is that there are very few cases where components can be moved out of the die laterally without putting a strain on some of the ejectors.

Methods falling under this heading have, however, been used successfully with tools not provided with ejectors, and notably on machines in which both die members retract from the casting. This is the case when the casting is left supported on a vertical core as the die members separate. The supporting core is raised to strip the component against a fixed housing. At the moment it reaches the stripping position, a swinging arm having a pair of gripping jaws is brought up to engage the casting.

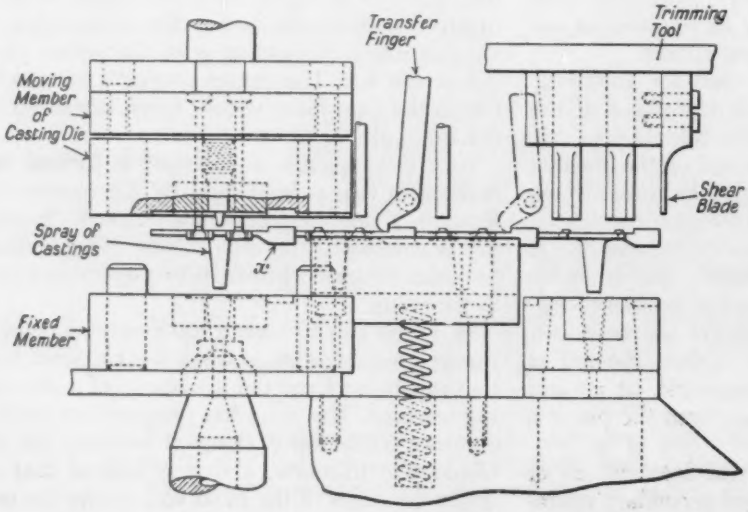


Fig. 10. With this arrangement, each spray of parts is cast to the runner of the previous spray. Thus, a rigid strip is obtained that is easy to handle and trim.

Transferring Joined Castings

In certain cases, the carrier member can be eliminated and a previously formed casting used to withdraw another from the tool. This method is used in the setup shown in Fig. 10. A multiple-cavity die is being employed to produce a center-gated spray of small parts.

The trimming tool is mounted alongside the die, and a registration block is located between them. Spacing between the two tools is such that at each cycle a portion of the previously cast spray projects into an enlarged section of the runner cavity in the die. At injection, the new spray is joined at point x to the spray cast during the previous cycle.

Transfer fingers engage the runner of one of the intermediate sprays and, when the die has opened, move the whole assembly laterally. This brings a fresh spray into line with the trimming die and aligns the trimmed spray with the shear blade seen in the right-hand side of the illustration. The shear blade cuts the continuous runner into short lengths for re-melting.

Unloading Fixtures Handle Large Castings

All of the transfer methods considered so far have been restricted, to a great extent, to the production of small castings. It is doubtful whether similar devices could be applied to the general run of die-cast components weighing from approximately six ounces to six pounds. On the other hand, there are many advantages in mechanizing casting removal on large, semi-automatic machines operating at relatively slow speeds, particularly when the components are awkwardly shaped for manual withdrawal.

In such instances, the use of a mechanical removal device can be regarded primarily as a safety measure. Transfer units can be fitted with limit switches to prevent premature die closure. In the case of multiple-cavity dies, mechanical withdrawal insures that all castings in a spray remain correctly positioned for trimming.

In its simplest form, a transfer device for commercial die-casting machines consists of a pair of guide rails extending transversely across the die carriage and a rolling, or sliding, carrier adapted to engage the casting. On machines with pre-set cycle timing, the carrier may be actuated by a long-stroke pneumatic cylinder; but this method has little advantage over hand movement.

Operational sequence of a machine fitted with this type of transfer device is as follows: die closure, injection, and die opening proceed normally; but prior to ejection the carrier is moved into alignment with the casting. Movement of the ejectors transfers the casting to the carrier, whereupon the ejectors retract and the carrier is free to be withdrawn from the die area. This sequence is applicable only to machines that eject by means of either a built-in hydraulic ram or a manual rack-and-pinion arrangement. Transfer devices can, however, be used on machines having bumper-bar ejection, but the mechanism would be so elaborate that in the majority of instances it would be preferable to change the ejection to suit simpler means of withdrawal.

Location of the component in the carrier is not critical. It is usually sufficient to position the part by the sprue and by two or more projecting studs on the runner or overflow, as illustrated in Fig. 11. If the component has holes cored from the fixed die member, they can be used for location. It is not desirable to locate from the edge of the runner or casting, as the flash formation may interfere.

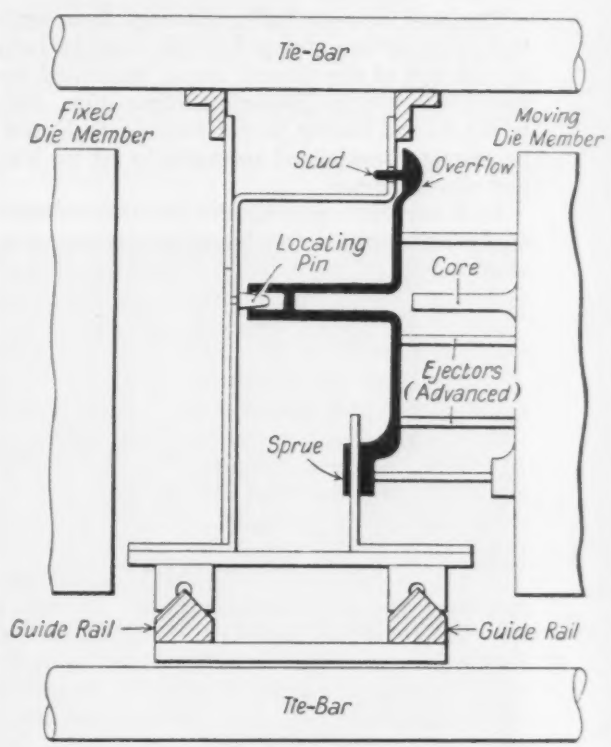
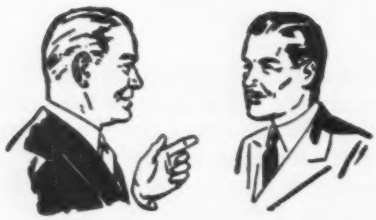


Fig. 11. Transfer device for a large casting has a box-like carrier that moves on slides. These slides are situated at right angles to the direction of die movement. A locating fixture on the carrier receives the casting from the ejectors.



Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Staff and Line Responsibilities

IT has been suggested that the terms "staff" and "line," as applied to business officials, hark back to biblical times when the leading vocations were herdsmen and fishermen. If so, their meaning has greatly changed since then.

Confusion between staff and line duties causes misunderstandings that eventually lead to friction and the misapplication of valuable talents. A review of his organization will help the sales manager to see that these forces do not overlap in their duties and that by working together they are achieving maximum results.

The staff idea—probably inherited from military organization—springs from the need for help on the part of the general. As an individual, he found difficulty in gathering information, analyzing it, and issuing proper commands. Hence, he engaged specialized assistants to act for him and also to advise.

With corporate growth and functional definition there emerged two broad classes of effort. One was to *do,* the other to determine the *way* or *method* to be followed. The line authority says "do," the functional authority says "do it this way, when you do it."

On the industrial organization chart we associate line activities with making physical things, whether design, equipment, or orders. Each activity approximates a separate kingdom, with authority extending down step by step. In contrast, staff activities usually furnish specialized services and advice to meet the needs of all.

Though the division of effort according to line functions may be reasonably exact, we find a wide difference in implementation. Within an industrial sales organization, selling or making orders is a line function. It must be supported by staff functions which furnish several services such as planning, promotion, or the analysis of markets or marketing.

One reason a sales manager succeeds is his ability to recognize all line and staff functions according to their importance; then to select top-grade men whose traits and experience fit them for one or the other character of work. As any form of organization presents danger and difficulty, let us point to a few that particularly refer to the working relationship of "men in the line" and "men on the staff."

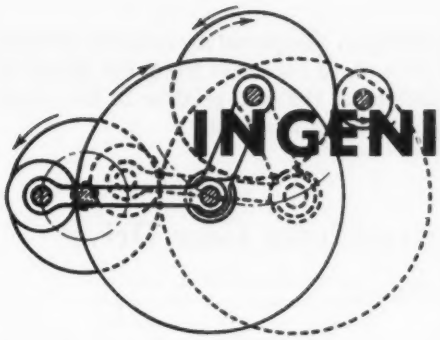
Since the line organization is the action group that produces prompt, easily recognized results, it has certain potential weaknesses. It is inclined to follow the force of habit, become satisfied with existing methods, and resent suggestion and change. It likes the practical and proven, rather than the theoretical. Therefore, it is vitally important to indoctrinate the line with what the staff can do to help them increase volume, quality, and efficiency.

On the other hand, staff men may be tempted to display their knowledge, to speak too much and too quickly—even to command. The most successful staff men have had experience in the line. They have tact and diplomacy.

Where the value of staff functions is fully appreciated, there may be a tendency to employ too many staff men since their achievements—as opposed to salesmen's—cannot be easily and quickly measured. Many staff men quite innocently may become too involved in gathering what they think to be valuable data—some even "chase butterflies."

As an organization grows in size, some sales managers are inclined to appoint staff assistants without other portfolio than that of administrative assistant. There is always danger from introducing one more step between sales manager and line or staff official. Spread and pass down authority. Preserve the direct route for human contact.

Reviewing the advantages of staff and line organization as well as its dangers is a rewarding experience for every sales manager. The line needs both special knowledge and the broader viewpoint of the staff. The staff needs the line, for in it there is found the testing ground and the reward of improved ideas put to work. What is supreme is an understanding by all of what the other half does, how it benefits the whole and, especially, the individual.



INGENIOUS MECHANISMS

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Timing of Cam Changed While Machine is in Motion

By WILLIAM M. FOSTER, New Hyde Park, N. Y.

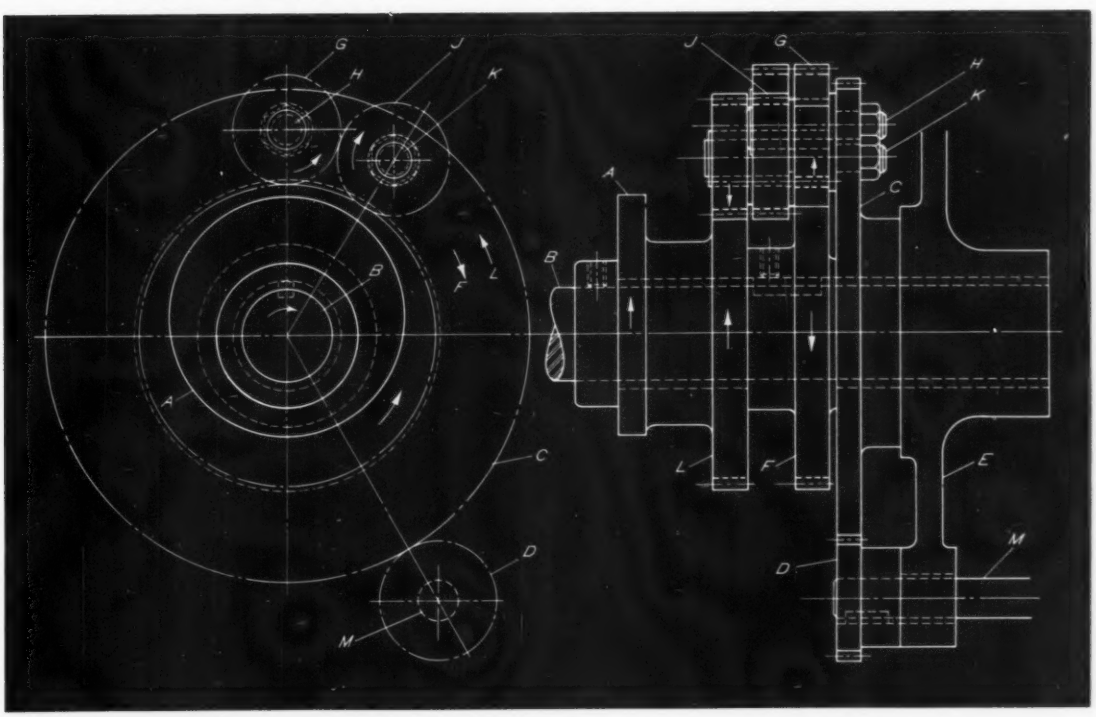
A machine used in the paper-converting industry required a means of changing the timing of a rotating cam. Because backlash and deflections encountered under speed and variations in the material being processed had to be taken into consideration, accurate timing could not be obtained with the machine not running. In the accompanying illustration is shown how the timing was changed while the cam was rotating.

To rotate the cam *A*, it is mounted over, but free on, input shaft *B*. Planet carrier *C*, also free on the input shaft, is normally locked from turning by engagement with pinion *D* carried by stationary bracket *E*. Gear *F*, however, is keyed to the input shaft.

The planet carrier supports two long pinions: pinion *G* on stud *H*, and pinion *J* on stud *K*. One half of pinion *G* meshes with gear *F*, and the other half meshes with one half of pinion *J*. The other half of pinion *J*, in turn, meshes with gear *L* which is an integral part of the cam.

Gears *F* and *L* are the same size, and pinion *G* and *J* are the same size. As a result, when the input shaft and gear *F* revolve, gear *L* revolves at the same rate, but in an opposite direction, which is desired.

The gear train from (F) to (L) permits the timing of cam (A) to be changed while it is rotating.



To change the timing of the cam without stopping its rotation, it is only necessary to rotate the planet carrier slightly, by turning pinion *D*. This can be done through a lever (not shown) attached to shaft *M*. The planetary action of pinions *G* and *J* adds to, or subtracts from, the speed of gear *L*, displacing the cam relative to the other moving parts of the machine.

Variable Intermittent Movement Derived from Gear Drive

By W. M. HALLIDAY, Southport, England

An unusual mechanism which provides intermittent movement from a standard gear drive is here illustrated. The amount of movement of the driven member is variable within wide limits and is easily adjusted to any degree of arc.

In this mechanism, driving gear *A* revolves freely on stationary shaft *B* and is retained in position by collar *C*. Three concentric bores in gear *A* contain the elements of the intermittent movement device. A rectangular flange *D*, machined integrally on shaft *B*, provides a mounting surface for slide *E*. Two screws *F*, passing through elongated holes in the slide, fasten it to the base of a deep slot machined across the flange face. These holes permit the degree of intermittent movement obtained from the mechanism to be varied.

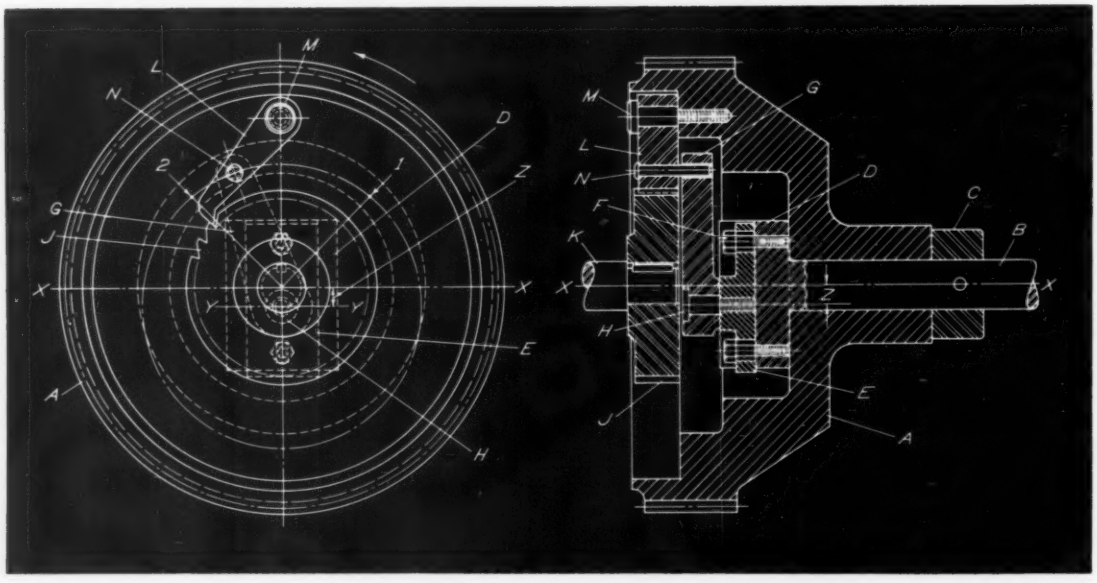
A lever *G* pivots freely on shoulder-screw *H*. The screw is threaded into slide *E* at a point below the center of gear *A* as indicated by dimension *Z*. Ratchet wheel *J* is keyed to a shoulder on the end of output shaft *K*.

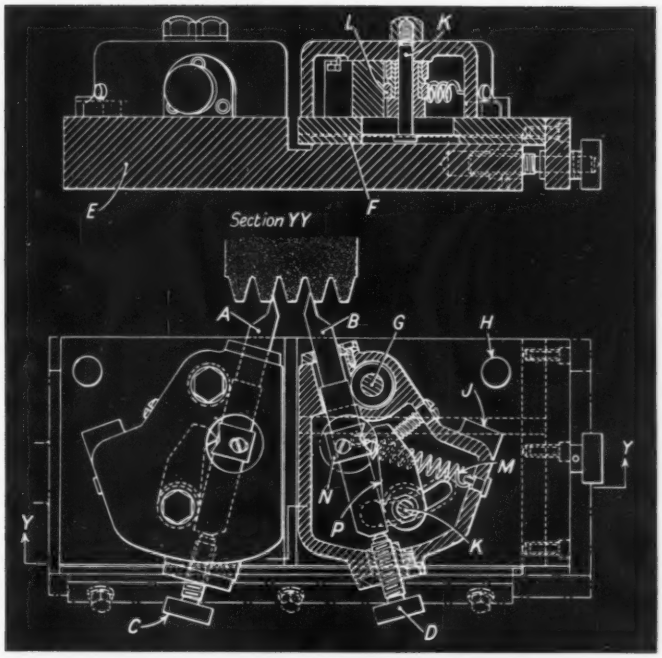
Motion is transmitted between gear *A* and ratchet wheel *J* by means of pawl *L*. The pawl is secured to gear *A* by shoulder-screw *M*. Driving pin *N* is pressed into the pawl and passes through a short elongated hole in lever *G*. The purpose of this connection is to control the swinging movement of the pawl.

As driving gear *A* rotates in the direction indicated by the arrow, ratchet wheel *J* is forced to revolve in the same direction due to the engagement of pawl *L*. Because driving pin *N* is connected with eccentrically mounted lever *G*, the pin moves in a circular path that is not concentric with shaft *B*. Thus, as gear *A* rotates, the pawl is successively drawn closer to, then farther away from, the teeth of the ratchet wheel. In this way, an intermittent motion is imparted to output shaft *K*.

With slide *E* located so as to provide an offset equal to distance *Z*, the ratchet wheel will rotate approximately 45 degrees during each revolution of gear *A*. The length of engagement between the pawl and the ratchet wheel is denoted by numbers 1 and 2 in the left-hand view. By adjusting the position of slide *E*, the distance traveled by the ratchet wheel can be varied.

Drive mechanism designed to convert constant rotary motion into variable intermittent rotary motion.





Attachment for diamond dressing a continuous helical rib on the abrasive wheel of a gear-grinding machine. By changing cam (N), the wheel may be dressed to various profiles.

Wheel-Dressing Attachment for a Gear-Grinding Machine

A patented attachment for dressing a continuous helical rib on the abrasive wheel of a gear-grinding machine is shown in the accompanying drawing. The attachment is mounted on the compound slide of the machine. During dressing, it is traversed parallel with the axis of the wheel-spindle by a screw driven from the spindle through pick-off gears.

Dressing is carried out simultaneously on both flanks of the helical rib by separate diamonds mounted in holders *A* and *B*. The holders are set to correspond with the pressure angle of the gear to be ground. At the end of the dressing stroke, the cross-slide and attachment are moved away from the spindle by hand, so that the diamonds clear the wheel.

Then, the longitudinal slide is returned to the starting position by power traverse. Next, the cross-slide is brought to the dressing position, and the diamond holders are adjusted lengthwise by means of screws *C* and *D* for applying another cut. In this way, the rib on the grinding wheel is dressed to its full depth in several passes.

The housing for the left-hand diamond holder *A* is fixed to base *E*, which is secured to the compound slide of the grinder. A slide *F* is provided for the right-hand diamond holder *B*. With this arrangement, the right-hand holder can be moved toward or away from the left-hand holder by means of a screw, for setting the distance between the diamonds in accordance with the required width of the helical rib to be dressed.

Since both diamond-holder assemblies are of similar design, only the right-hand unit will be described. This unit can be pivoted about pin *G*. The diamond holder *B* is set to the required angle by means of gage-blocks, which are placed between the periphery of reference pin *H* and the machined surface *J*. The unit is then secured to slide *F* by nuts on the threaded upper ends of pins *G* and *K*. The enlarged-diameter lower end of pin *K* engages a T-slot in the slide.

An eccentric ring *L* is keyed to a sleeve surrounding the pin *K*. Diamond holder *B* is held in close contact with this ring and a sleeve surrounding pin *G* by a tension spring *M*. When a wheel for grinding gear teeth of modified involute form is to be dressed, a plate type cam *N* is attached to the diamond holder. This cam is engaged by a follower-arm *P*, which is also keyed to the sleeve surrounding pin *K*.

When the diamond holder is adjusted lengthwise at the end of each dressing stroke, the action between the cam and follower-arm causes the eccentric ring *L* to be rotated through a small angle. As a result, the diamond holder is set in different angular positions during the dressing operation so that a rib with curved flanks is formed on the wheel. By using cams of different shapes, the wheel may be dressed to grind gears having modified profiles over part or full tooth depth.

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Send a scale drawing (or photograph—or both) that shows the operating principle and important parts involved. Clear blueprints or pencil drawings are acceptable, but free-hand sketches cannot be used.

Describe the *purpose* and *action* of the mechanism—*how* it does *what* it does. Your description need not be in polished English, but it should be clear and logical.

Mark details on drawing, such as levers, cams, and gears, with letters *A, B,* etc., and use corresponding letters to identify those details in the description; thus, "Lever *A* is operated by cam *B*." (A suggestion: See how articles in this issue's "Ingenious Mechanisms" section are handled.)

Substitute a diagram for the drawing, if necessary, to illustrate the arrangement of a complicated mechanism.

what we do

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TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Faceplate Fixture Facilitates Precise Spacing of Bored Holes

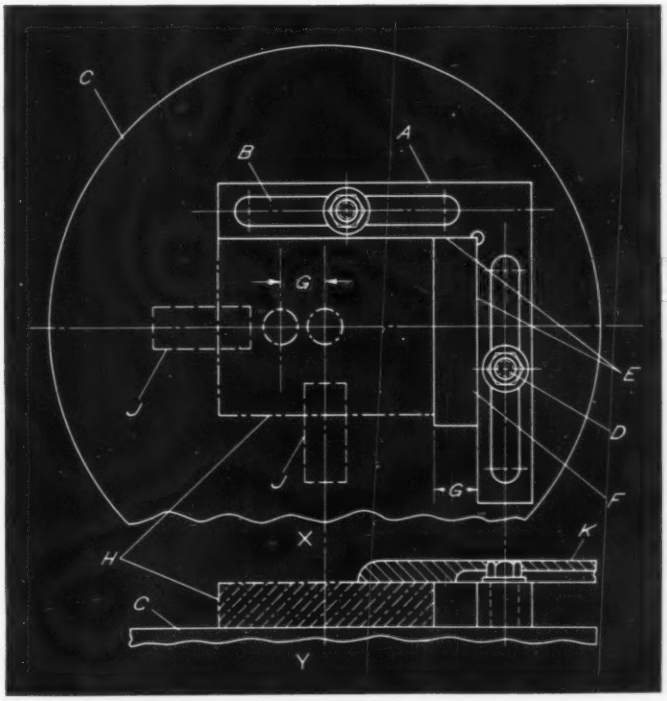
By F. L. RUSH, Columbus, Ohio

A fixture that readily permits accurate spacing of holes to be drilled and bored in work-pieces held on the faceplate of a lathe is shown in the accompanying illustration. The two inner perpendicular edges of an L-shaped frame and a special gage-block are used to locate the part after boring the initial hole.

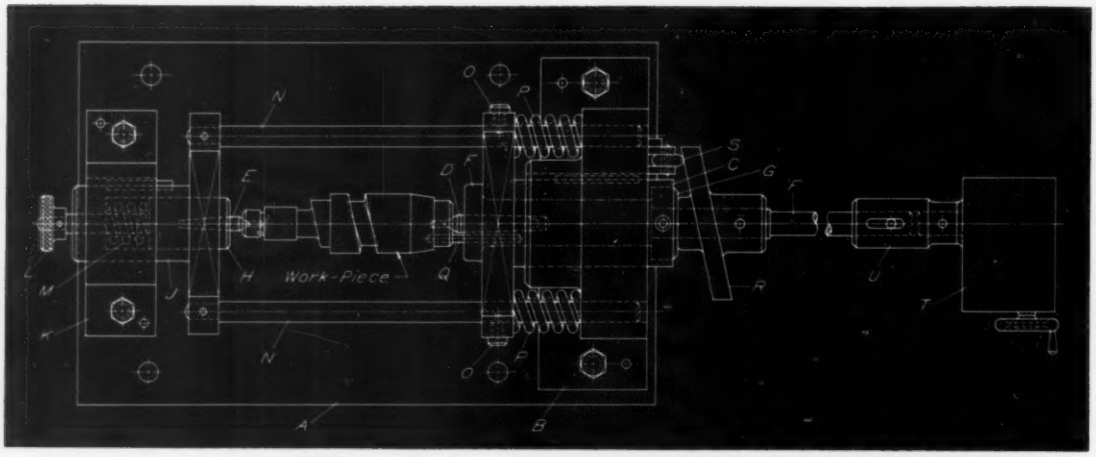
The fixture frame *A* is made in one piece and ground all over. Slots *B* are cut in each leg of the frame to provide a means of securing it to the faceplate *C* with machine bolts *D*. The two inner surfaces *E* have to be precisely 90 degrees to each other and the base. A gage-block *F* is made and accurately ground to any desired spacing between the holes, see *G* in the illustration.

In use, the work-piece *H* is first secured to the faceplate with clamps *J*, shown dotted in view X, in position for boring one of the holes. The fixture and the proper gage-block are then bolted in place. The frame is carefully fitted against the work-piece as any misalignment between the part, the fixture frame, and the gage-block would cause inaccurate spacing. Accurate positioning can be accomplished by using cigarette papers as feeler gages between these three pieces. The fixture and the gage-block should be tapped in place with light blows of a soft hammer until the cigarette papers are snugly held between the surfaces in question. The special clamp *K*, shown in view Y, and the bolts are are then firmly tightened, and the hole bored to size.

The second hole in the part is then accurately spaced simply by loosening the clamps holding the work, leaving the fixture frame firmly clamped, removing the gage-block and sliding the work-piece over into contact with the leg of the frame. This is the position left vacant by the gage-block spacer. The clamps are then tightened to hold the part and the hole is bored to size. A suitable counterweight is clamped to the faceplate of the lathe to balance the fixture and the work-piece.



Work-pieces requiring holes having close-tolerance spacing can be quickly positioned for boring on a lathe faceplate equipped with this fixture.



Milling fixture allows an inclined annular groove and an inclined face to be cut with an end-mill. Swash-plate (R) is rotated by speed-reducing unit (T) and guides the longitudinal feed of the work-piece.

Fixture for End-Milling an Inclined Annular Groove

WILLIAM H. MORSON, Birkdale, England

An inclined groove can be cut easily around the periphery of small cylindrical components on a milling machine. Such a method was used to machine both a groove and an inclined shoulder on a brass spindle. A finished spindle, 3.125 inches long, is shown mounted in a special milling fixture in the illustration.

The fixture, which is intended for use in conjunction with a vertical milling machine tooled with the correct size of end-mill, is built up on a ground baseplate *A*. Although not shown, the under side of the baseplate may be provided with tongues for engaging the T-slots in the machine table.

Bearing bracket *B* is held to the top of the baseplate by two bolts and two dowel-pins. The upright portion of the bracket is bored to receive cylindrical sleeve *C*. A key allows the sleeve to slide freely within the bracket but restrains it from turning.

The work-piece is mounted between centers *D* and *E*. Center *D* is mounted in a tapered hole in the flanged end of shaft *F* which, in turn, is a close running fit within sleeve *C*. Collar *G* nests in a recess in the right-hand end of sleeve *C* and is pinned to shaft *F*.

Center *E*, at the left-hand end of the work-piece, is mounted in a tapered hole in plug *H*. The plug can both revolve and slide within a counterbore in sleeve *J*. A key prevents the sleeve from rotating but permits it to slide smoothly within a hole bored through bearing bracket *K*. As is the case with bearing bracket *B*, bracket *K* is fastened to the baseplate by two bolts and two dowel-pins.

Knurled knob *L* is pinned to a slender shaft that is integral with plug *H*. The knob is used for retracting the plug and center when loading or unloading a work-piece. A stiff compression spring *M* is positioned behind plug *H* and forces it to the right to maintain engagement between center *E* and the work-piece.

Turned integrally on the left-hand end of sleeve *C* is a large flange, the upper and lower sides of which are machined flat. Two holes are drilled through the flange to receive guide rods *N*. Each rod is secured within the flange by a dog-end set-screw *O*. The portions of the guide rods that extend to the right-hand side of the flange slide within holes drilled through bearing bracket *B*. Two compression springs *P* are interposed between the flange and the bearing bracket.

A flange, similar to the one on sleeve *C*, is machined integral with the right-hand end of sleeve *J*. The left-hand end of each guide rod *N* is slightly reduced in diameter and is a tight fit within holes drilled through the flange. The rods are secured by cross-pins.

With this linkage system, any sliding movement imparted to sleeve *C* and shaft *F* is transmitted to sleeve *J* at the opposite end of the fixture. It should be noted that, while such sliding movement is taking place, both shaft *F* and plug *H* are free to rotate. Pin *Q*—a press fit in the flanged end of shaft *F* and a slip fit in a blind hole in the work-piece—serves as a driving dog.

Sliding movement is imparted to sleeve *C* and connected members by hardened steel swash-plate *R* which is cross-pinned to the small-diameter end of shaft *F*. The angle of inclination of

the swash-plate is the same as that of the annular groove and shoulder face to be machined on the work-piece. A roller *S* is supported by a shackle extending from the outside face of bearing bracket *B* and bears against the inclined face of the swash-plate.

The extreme right-hand end of shaft *F* is connected to the output shaft of a standard, manually driven speed-reducing unit *T*. The two shafts are joined by coupling *U* that permits positive rotation of shaft *F*, at the same time allowing it to slide to the right or left.

When the fixture is to be used, knurled knob *L* is drawn to the left, and the work-piece is mounted between centers *D* and *E* and in engagement with pin *Q*. An end-mill of the same diameter as the width of the groove to be cut is placed in the machine spindle. The cutter is fed into the work to the required depth, and the handwheel on speed-reducing unit *T* is slowly turned. This movement causes swash-plate *R* and shaft *F* to revolve. Springs *P* hold the rotating swash-plate in contact with roller *S*. Thus, as rotation proceeds, sleeve *C*, guide rods *N*, sleeve *J*, and related parts (including the work-piece) move gradually in a longitudinal direction, resulting in the reproduction of an accurate inclined groove. When machining the inclined shoulder, an end-mill with a rounded cutting edge is required to reproduce the small fillet.

Use of Automatic Screwdriver Extended with Ratchet Wrench

By Clint McLaughlin, Rockaway Beach, N. Y.

The automatic screwdriver illustrated has been modified by the addition of a ratchet type box wrench to permit application of greater torque. Through this arrangement, the operator can effect the final tightening or initial loosening of a screw with a minimum of effort.

A flanged nut *A* of appropriate size is brazed to each screwdriver bit *B* on which the modification is desired. Before inserting the bit in the screwdriver C, a ratchet type box wrench *D* is slipped over the shank and onto the nut. A flat washer *E* is then placed on the bit. By positioning the flanged nut on the bit so that the flat washer rests up against the face of the screwdriver chuck, the wrench is restrained in place on the nut. The wrench handle also provides a convenient means for holding and guiding the bit during operation.

When using this screwdriver for loosening screws, the wrench is removed and turned over so that the ratchet works in the opposite direction. Normal operation is not affected by the alteration since the wrench is easily removed from the bit.

Nut (A) is brazed to screwdriver bit to allow use of ratchet wrench. Change from loosening to tightening is accomplished by removing, turning over, and replacing wrench.

SHOP KINKS

Fixture Permits Rapid Grinding of Slitting Saws

By H. J. GERBER, Stillwater, Okla.

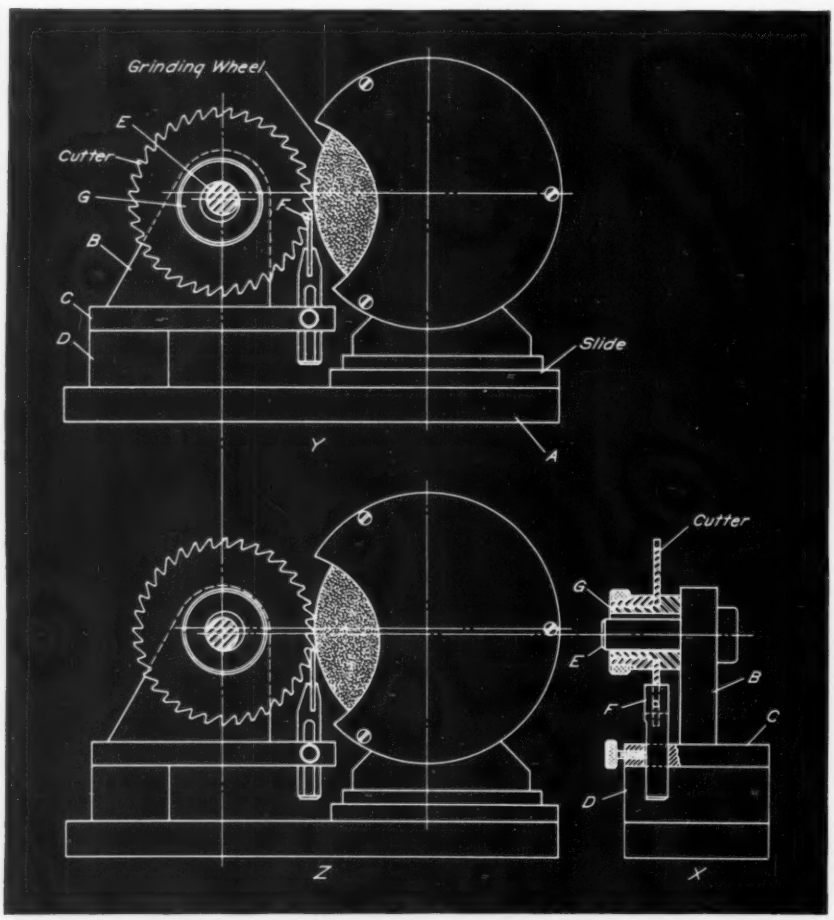
A conventional bench type tool-grinder can be adapted for the rapid grinding of slitting saws by means of the setup illustrated. The grinder is mounted on a slide on steel baseplate *A*. To this plate is also secured a supporting and indexing fixture for the cutter to be sharpened.

Upright bracket *B* of the fixture is supported by mounting plate *C* which, in turn, is bolted to block *D*. Pressed into the upright bracket, slightly below the grinding-wheel center line, is a hardened and ground steel stud *E*. An adjustable tooth-rest *F* is positioned on the overhanging portion of mounting plate *C*.

A two-piece bushing *G*, machined to fit snugly into the arbor hole of the saw as shown at X, is turned from steel bar stock. The outer member of the bushing is knurled on its periphery. The bushing, or adapter, is used to insure the alignment of the cutter on the stud.

Operation of this device is not involved. The cutter, mounted on its adapter, is slipped over the shaft end of stud *E* and banked against the upright bracket. The center hole of the bushing is bored to a larger diameter than the body of the stud (exaggerated in the illustration), so that the cutter and bushing assembly is mounted loosely. Tooth-rest *F* is then adjusted so that it supports the tooth below the one to be ground. Also, adjustment of this tooth-rest permits the proper relief angle to be obtained. When this has been done, the device will appear as shown at Y.

To bring the cutter into contact with the grinding wheel, bushing *G* is gripped on its knurled rim, then lifted up, and pushed toward the grinder as shown at Z. The grinder should have previously been adjusted on its slide, so that the desired depth of grind will be obtained when stud *E* halts the forward motion of the cutter. After grinding the first tooth, the bushing is returned to its original position, thus allowing the next tooth to engage the tooth-rest. In this way, each tooth is plunge-ground in turn.



Simple fixture utilizing conventional bench type grinder for sharpening slitting saws

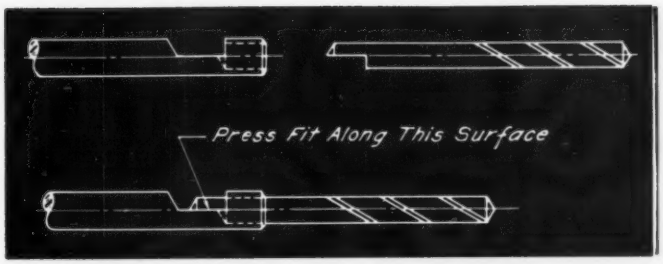


Diagram of an extension-adapter for a drill from which the drill can be easily removed for re-use in normal drilling operations.

Extension-Adapter for Twist Drills

By FREDERICK BARKER, Ilion, N. Y.

An extension type drill adapter, designed to permit easy removal of drills so that they may be used for normal drilling operations, as required, is here shown. A light tap on the shank end of the drill is all that is necessary to remove the drill from the extension-adapter. This is not possible when the customary practice of brazing the drill into an extension is followed.

To make the adapter, a hole (approximately 1/2-inch deep) is drilled in one end of a steel rod. The shank of the drill should be a close sliding fit in this hole. Rotation of the drill in the adapter is prevented by the engagement of a flat surface machined on the extension in back of a solid collar, as shown, and a flat surface on the drill shank. When the drill is inserted into the extension-adapter, the light press fit between the flat surfaces keeps the drill from working loose.

Dial Indicator Positions Spindle on Vertical Milling Machine

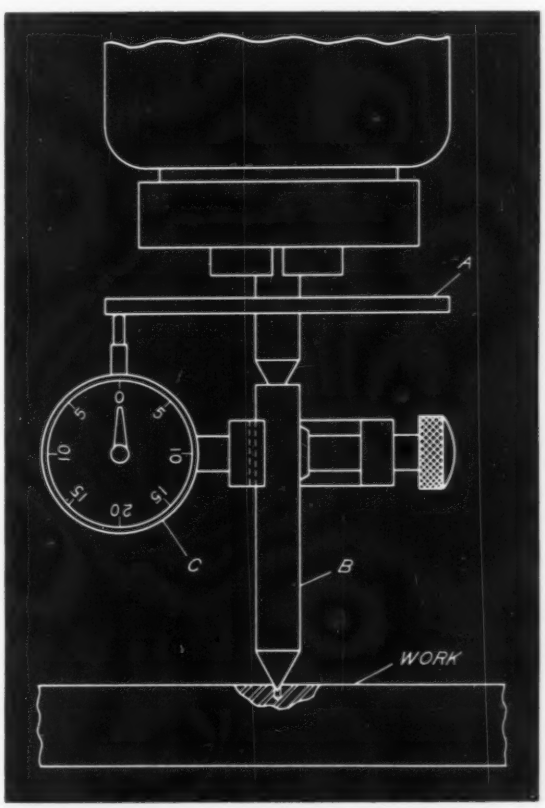
By J. RANDOLPH LUCAS, Richmond, Va.

When drilling or boring on a vertical milling machine, the work may be located accurately by means of a simple two-part fixture and a dial indicator. A fixture of this type and its application are here illustrated.

The flange of member *A* is turned concentric with the body and indicated to rotate true in the milling-machine spindle. A conventional 60-degree taper is formed on the end of the body. The work is center-drilled at the desired hole location and strapped to the machine table. By moving the table, the center-drilled hole in the work-piece is brought to a position approximately in line with the center of the machine spindle.

Part *B* is machined in the same manner as an ordinary lathe center, except that the body taper is omitted. Member *A* of the fixture is then inserted into a center-drilled hole in the rear of part *B*, and the front end of this second member is introduced into the locating hole in the work-piece. Dial indicator *C* is clamped securely to part *B* and is adjusted to produce a light pressure against the bottom face of the flanged portion of part *A*.

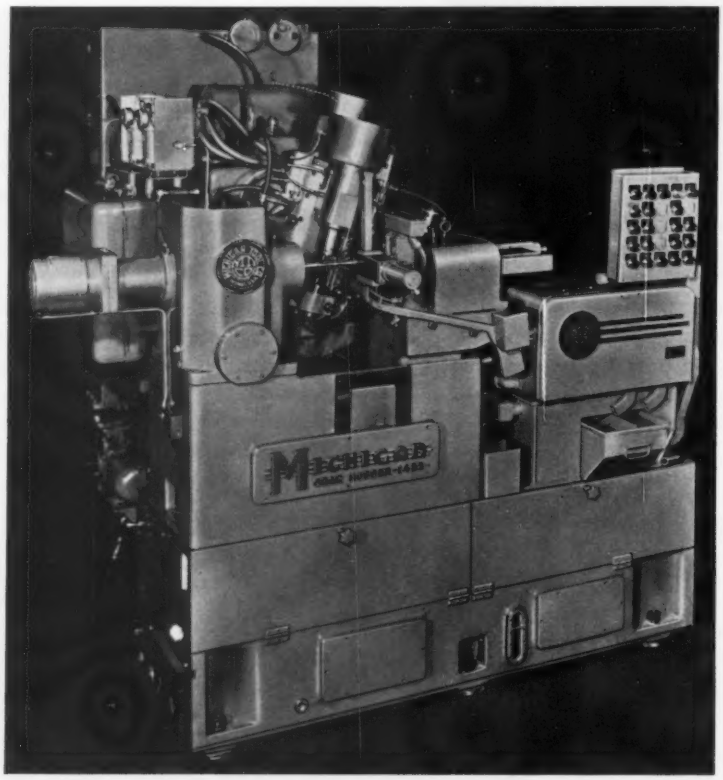
After locking the spindle in position, the bottom section of the fixture is rotated slowly by hand. The machine table is then adjusted until a zero reading is obtained at all positions on the flange of part *A*. When this is accomplished, the center of the spindle will be in direct alignment with the locating hole in the work.



This simple fixture utilizes a dial indicator to align a locating hole in a work-piece with the center line of the machine spindle.

LATEST DEVELOPMENTS

Machine tools, unit mechanisms, machine parts and



Michigan Tool Co.'s small-gear hobber with built-in parts conveyor

"Ultra-Speed" Gear-Hobbing Machine

The Michigan Tool Co., Detroit, Mich., has developed a new "Ultra-Speed" horizontal small-gear hobbing machine—designated Model 1433—that can be adapted to any degree of automation. Machines of this new design can be set up in tandem on a common sub-base and equipped for automatic through-feeding and removal of parts. Gear washers and gear classifiers can be integrated into the machine units, and provision is made for automatic size control.

All connections for machine service lines are self-contained in the sub-base, including air or hydraulic pressure lines for operation of feeds; self-contained coolant system or coolant piping for addition to central system; conveyor for removing chips; used-coolant return lines; conveyor lines to remove finished parts; and central system lubrication lines. The master panel and electrical connections are mounted in the sub-base, so that the hobbing unit can be readily removed without affecting "in line" gear production.

Although this single-spindle hobber incorporates advanced major engineering changes, it retains many of the high-production features of the earlier 1445 model. These include the "plunge" cutter feed and an automatic expansion arbor for work-holding.

The machine will hob up to 12-pitch spur or helical gears. Maximum center distance—hob arbor to work-spindle—is 3 1/4 inches. Maximum cross-feed stroke of hob is 4 inches. Gears with either right- or left-hand helix angles up to 30 degrees can be hobbed. In operation, the hob is plunge-fed into the work, eliminating the approach feed and thus obtaining a substantial reduction in hobbing time. The hob is then fed across the work, the stroke being completely adjustable. The plunge infeed and the cross-feed are powered by airdraulic cylinders. Feed rates for both the plunge and traverse feeds are infinitely variable. Setup is simplified by an arrangement whereby the gear helix angle is obtained by a simple setting of the hob spindle head. This eliminates the feed change-gears normally used for controlling the helix angle. Work rotation is preset, in timed relationship with the hob, by means of conveniently located change-gears.

The entire hobbing cycle is automatic, with loading time measured in seconds. Hobs revolve at variably selected speeds up to 500 R.P.M. Either conventional or climb hobbing may be used with single, double, or triple thread hobs. Provision is made for making three separate adjustments on the hob head to control the hob thread angle; gear helix angle; and the position of the automatic hob shift. Other features of the machine include a one-piece work-drive housing containing a ruggedly constructed work-spindle. Heavy taper roller bearings support the spindle for hobbing with or without the tailstock. Lubrication is of the automatic oil-air mist type. This can be provided individually or as a central lubrication system for tandem machines. All controls are safety interlocked, and all circuits conform to JIC standards.

Circle Item 101 on postcard, page 241

IN SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON

Heald "Bore-Matic" Designed to Handle Wide Variety of Work by Means of "Off-the-Shelf" Units

A high-precision, small-parts finishing machine, especially designed for versatility and economy, has been developed by the Heald Machine Co., Worcester, Mass. This machine, known as Model O "Bore-Matic," has been designed around a number of standard, interchangeable, or "building-block," units and can be set up as a dozen different basic machines with hundreds of combinations in tooling and fixture equipment to perform innumerable boring, facing, turning, chamfering, grooving, and similar operations.

Standard tooling equipment includes a variety of interchangeable boring head and drive units, and manual or hydraulic cross-slide attachments. Thus, a wide variety of custom-built setups that would otherwise require a specially designed machine for each application can be assembled.

The table has a maximum travel of 9 inches and a pad surface 12 by 12 inches. The cross-slide pad is 9 by 9 inches, and the distance from top of table to floor is 41 inches. Rapid traverse of the table is at the rate of 15 feet per minute, and the available feeds range from 1/2 inch to 50 inches per minute. The standard drive for the head is a 56-frame, 1/2-H.P. motor with a speed of 1650 R.P.M. The oil-pump motor is 1/4 H.P. and has a speed of 1800 R.P.M. A similar motor is used for the cutting fluid unit. The machine, without separate cutting fluid tank, requires a floor space 36 15/16 by 48 inches and, with average tooling, weighs approximately 1680 pounds.

Multi-spindle boring heads with interchangeable front plates can be arranged in any combination for center distances as close as 3/4 inch. A cross-slide is used for bores with center distances closer than 3/4 inch by indexing to another spindle cluster on the same plate. Heads are driven by a single belt from a motor mounted on top of the head unit. (See Fig. 2.)

The multi-spindle assembly consists of a heavy, cast-iron supporting frame arranged for mounting a spindle plate which is precision-bored to receive the required number of spindles in their desired positions. A variety of spindles, ranging from the 3/4-inch miniature size up to 3 1/2 inches, can be used in combination. Each boring head is a high-precision unit complete with spindle, bearings, cylindrical housing, drive pulley, and provision for attaching the required tooling.

Spindle plates are interchangeable and can be mounted in the supporting frame with precise alignment. A single plate can be bored to a specific head setup for

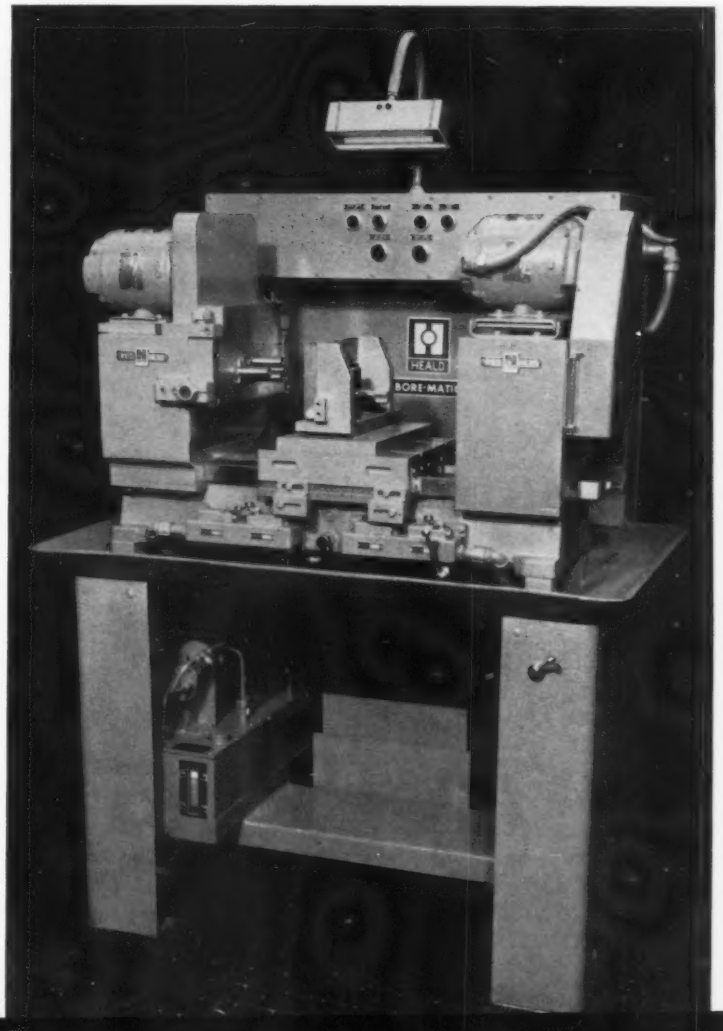


Fig. 1. "Bore-Matic" available with variety of "off-the-shelf" packaged units that cover a wide range of precision finishing operations.

each multiple-hole boring job. When the holes do not overlap, one plate can be used for several different jobs by mounting the heads only in the spindle plate holes required for each job and leaving the others empty.

Boring head and drive units in cast-iron frames can be mounted on either end of baseways, keyed between ways and clamped with hold-downs for accurate alignment and easy interchangeability. Motor with hinged tension plate is mounted on top of head unit.

Hydraulic cross-feed units, complete with hydraulic operating cylinders and controls, are available for both the standard and multi-spindle boring heads. They permit grooving and facing operations to be performed with rotating tools. Air cylinders can also be supplied to operate chucks and arbors for holding rotating work.

The swivel boring head support, for single boring head units, can be turned 10 degrees on either side of the center line. This permits taper boring and turning of rotated work. Hydraulic and manual cross-slides permit precision horizontal indexing of work or tooling for multiple-hole boring and for generating faces, grooving, and under-cutting rotating work.

The universal fixture consists of a manually operated vertical work-slide mounted on the cross-slide or table. It provides extremely accurate horizontal or vertical indexing for multiple boring without rechucking the work. The coolant pump and tank form a self-contained unit. The basic machine is mounted in a large, flanged chip pan, and the coolant pump and tank can be added.

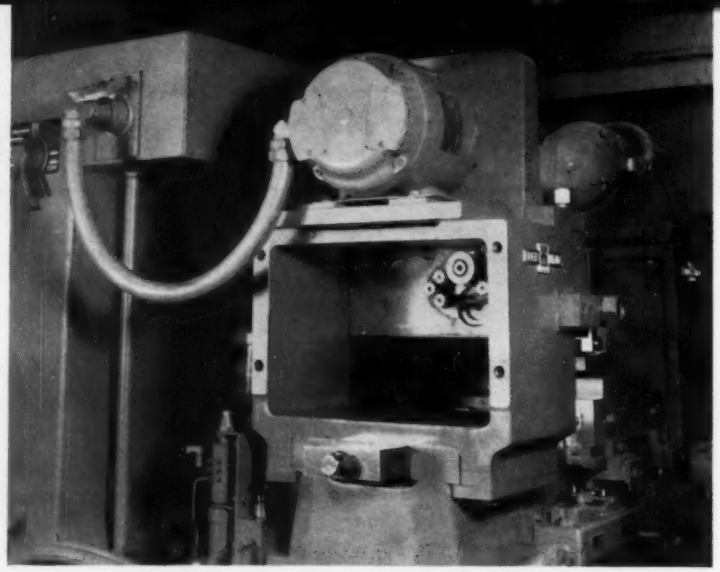
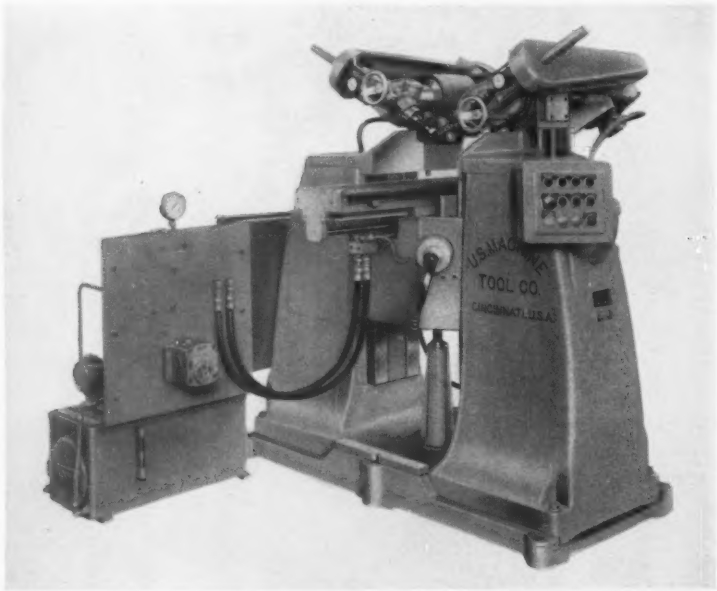


Fig. 2. Heald multi-spindle boring head shown from the rear on machine seen in Fig. 1. This assembly consists of a cast-iron supporting frame arranged to mount a spindle plate which is precision-bored to receive the required number of spindles

Circle Item 102 on postcard, page 241

U. S. "Hy-Flex" Double-Column Hydraulic Milling Machine

A versatile, double-column, hydraulic milling machine, called "Hy-Flex," has been developed by the U. S. Burke Machine Tool Division, Cincinnati, Ohio. This machine is equipped with independent milling heads, which can be positioned to suit the user's requirements. Unit construction permits mounting heads of any type in the required position for milling, drilling, grinding, boring, or special applications. Finish-machined column tops, approximately 12 1/2 inches square, provide adequate mounting surfaces for combinations of heads. For example, the machine can be equipped with two independent milling heads of the quill type. The double-column machine may be operated with heads leading or opposed to each other—in line with or tilted above or below the horizontal plane. Worm-gear drive permits swiveling the heads independently to any fine degree of elevation desired. The heads shown, or other combinations, are available with the machine. Those illustrated have a quill travel of 5 1/2 inches. An indicator and end-measuring rod give accurate adjustment.



Double-column hydraulic milling machine developed by the U. S. Burke Machine Tool Division

The "Hy-Flex" may also be equipped with four independently motorized, horizontally mounted, high-speed grinder spindles, two on each base. Because of standard unit construction, this machine lends itself to special applications at a nominal cost. The base is available separately, if desired, with full hydraulic longitudinal table feed.

The knee has a vertical travel of 15 inches and is center-positioned above the vertical screw. The table has a maximum stroke of 30 inches, adjusted by movable dogs; infinitely variable feed rate; forward and return jog; and automatic or semi-automatic cycling of rapid traverse, feed, return, and stop. Independent controls for table feed and head operation are mounted in a conveniently located panel separate from the machine.

Circle Item 103 on postcard, page 241

Manifold Design to Handle Unlimited Number of Oxygen Cylinders

An oxygen cylinder manifold designed to handle an unlimited number of cylinders, designated Oxweld M-35, has been introduced by Linde Air Products Company, a Division of Union Carbide and Carbon Corporation, New York City. As a basic unit, the manifold accommodates two cylinders—one on each side of the operating controls. Straight or curved extensions are then added in single or double rows to either bank, so that it is possible to manifold any number of cylinders. This makes it possible for the unit to supply any desired amount of oxygen to a piping system for welding, cutting, and other industrial uses.

One bank of cylinders can be operated independently while cylinders in the other bank are in reserve or being changed. When large flows are needed, both banks can be operated simultaneously. During alternate operation, the reserve cylinder bank automatically picks up the oxygen load when the supply in the operating bank is exhausted. Cylinders can be added or removed at any time to meet changing conditions.

Circle Item 104 on postcard, page 241

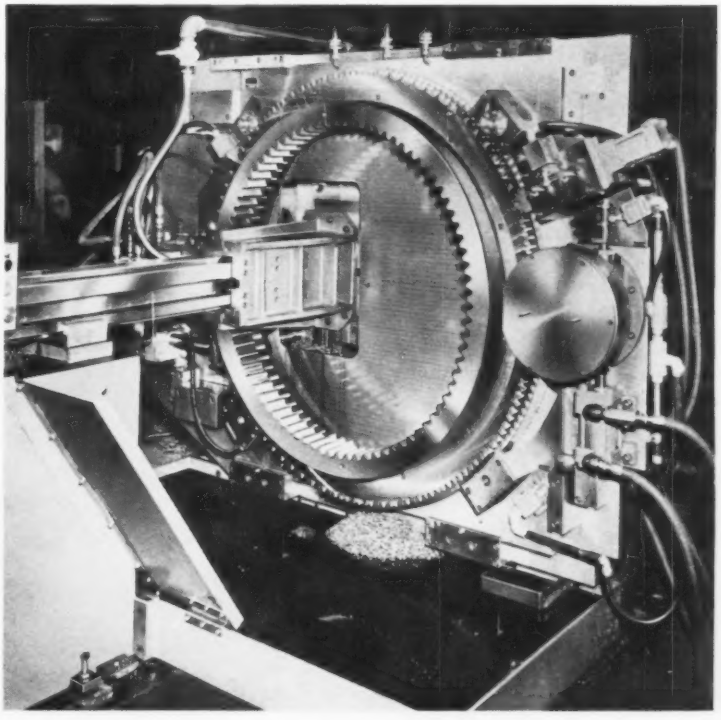
Horizontal Broaching Machine Equipped for Cutting Over-Size Gears

A universal horizontal broaching machine, with fixtures for use in cutting the huge gears for equipment vital to the national road-building program, has been developed by the Colonial Broach & Machine Co., Detroit, Mich. This machine broaches either finished spur or semifinished helical gears in a range of sizes up to 42 inches pitch diameter. It can also be used for cutting the large gears required for marine equipment, big presses, and heavy materials-handling devices.

Set up to cut a Tournapull tractor steering gear for LeTourneau-Westinghouse, Peoria, Ill., the machine reduced the tooth-cutting time from an all-day job to an hour and a half. This includes ten minutes for loading and unloading and ten minutes for reversing the broach. In this application, three parts are broached: a 65-tooth gear having a helix angle of 20 degrees and a pitch diameter of 32.5 inches with a length of cut of 4.5 inches; a 79-tooth helical gear with a pitch diameter of 26.33 inches, and a length of cut of 4.5 inches; and an 84-tooth straight spur gear having a pitch diameter of 42 inches and a length of cut of 4.37 inches.

The steering gear is clamped to the faceplate, which also holds the master indexing gear. Automatic shuttle and indexing movements are hydaulically actuated by a pin and gear tooth pawl arrangement. The gears are broached in two passes—a roughing cut and a finishing cut. Subsequent shaving or grinding operations are unnecessary for the spur gears. A special angle-plate bolted to the machine face is used for semi-finishing the helical gears. The machine used in this application is a 15-ton, 90-inch stroke model and is designed to offer a 40 per cent safety overload margin above the machine capacity. This minimizes shock and reduces vibration, besides giving reserve power when needed. Hydraulic power is furnished by a rugged, vane type pump.

Circle Item 105 on postcard, page 241



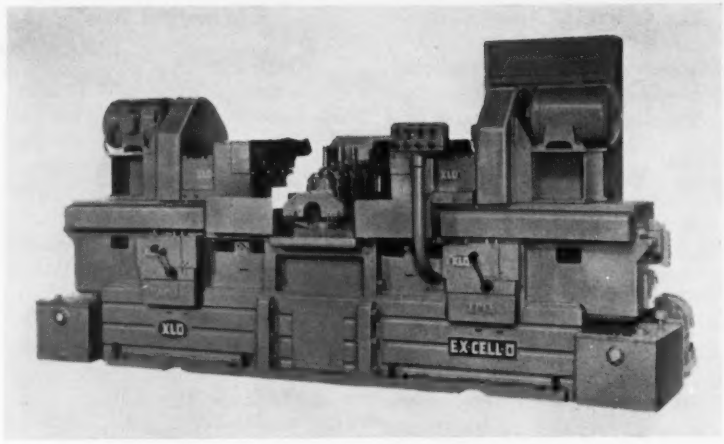
Colonial universal horizontal broaching machine

Two-Way Precision Boring Machine for Processing Universal-Joint Yokes

A two-way precision boring machine equipped for rapid production of yokes for automotive universal joints has been built by the Ex-Cell-O Corporation, Detroit, Mich. Fast production is made possible by performing operations at both ends of the workpiece simultaneously, using the slides mounted on the two ways of the machine.

The universal-joint yokes are clamped in fixtures and two holes are finish-bored in line. A three-station, hydraulically operated fixture and three boring spindles on each slide of the machine produce three machined yokes in each automatic cycle. This machine is applicable to work-pieces of many different sizes, weights, shapes, and machining requirements.

Circle Item 106 on postcard, page 241



Ex-Cell-O two-way precision boring machine for universal-joint yokes

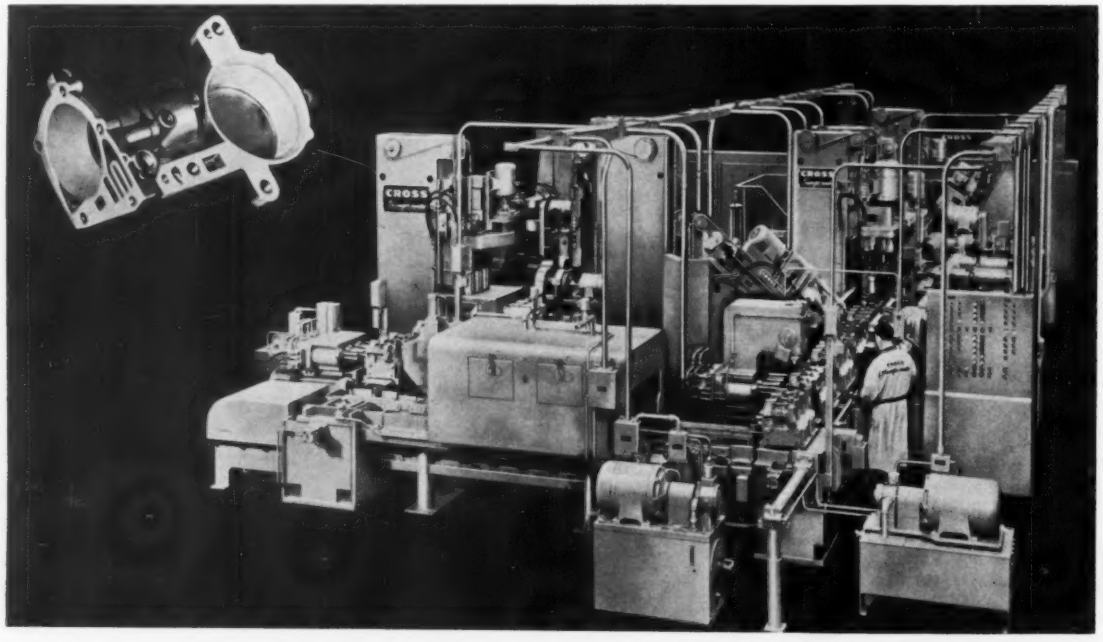
Transfer-matic Equipped to Machine Servo-Valve Bodies

The Cross Company, Detroit, Mich., has recently built a Transfer-matic that completely machines servo-valve bodies for automatic transmissions at the rate of 490 pieces per hour. This machine performs twenty-one drilling, six reaming, five tapping, six boring, and two facing operations.

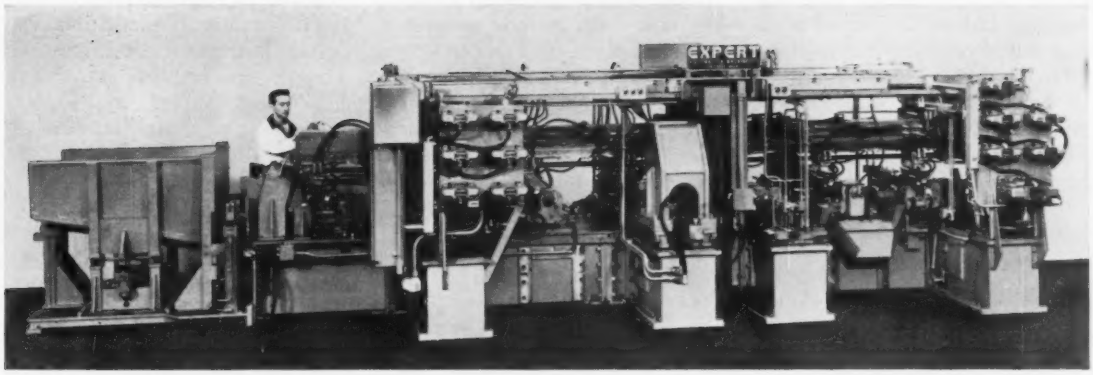
The parts travel through twenty-five stations—one loading, nine drilling, one tapping, two rough-boring, two precision-boring, two precision-facing, one washing, six visual inspection, and one unloading. Palletized work-holding fixtures each carry three parts. An unloading unit is provided for removing parts from fixtures and placing them on a conveyor.

This Transfer-matic has been designed for complete interchangeability of all standard and special parts to facilitate maintenance. "Building block" construction serves to provide flexibility for future changes in the design of the valve bodies. Other features of the machine include an automatic washing unit for fixtures, construction to JIC standards, hardened and ground ways, hydraulic feed, and rapid traverse for milling, drilling, and boring; and individual lead-screw feed for tapping.

Circle Item 107 on postcard, page 241



Transfer-matic built by The Cross Company for processing automatic transmission component



Seven-station "Weldamation" machine developed by the Expert Automation Machine Co. for machining, welding, assembling, and testing automotive steering columns

"Weldamation" Combination Machining, Welding, Assembling, and Testing Machine

A seven-station in-line processing machine developed by the Expert Automation Machine Co., Detroit, Mich., introduces an automated-production concept designated as "Weldamation." With this new method, metalworking machining operations are combined with those of welding, assembling, and testing in a single automated machine. The "Weldamation" concept can be applied in developing special machines of either in-line or rotary index types to suit the individual part specifications and the production requirements.

The weldamation machine illustrated assembles and welds a flange to one end of a steel tube, performs three separate machining operations on the other end of the tube, and tests the finished tubular steel automotive steering column thus assembled at a production rate averaging 400 units per hour.

Adjustments are provided on the machine to permit the handling of two different tube and flange components. Thus, by allowing for a short duration change-over period, the machine can meet the production requirements for two completely different steering column assemblies. The machine utilizes modular construction, which allows stations to be added with little loss in production time.

An automatic tube-loading mechanism transfers the tubes from a hopper to a longitudinally reciprocating transfer-bar mechanism which carries the parts through the assembly, welding, machining, and testing stations and deposits the completed assembly on a conveyor—the accepted assemblies being marked with a steel stamp. The seven-station in-line transfer machine occupies a floor space about 27 by 9 feet and is 6 feet high. The hydraulic power unit develops approximately thirty horsepower, which is available to actuate the assembly, welding, machining, and testing units.

Circle Item 108 on postcard, page 241

G-E Motor-Generator Welder

A line of motor-generator welders featuring pre-lubricated, sealed bearings, controlled current peaks, and space-saving design has been announced by the Welding Department of the General Electric Co., Schenectady, N. Y. These welders are of compact, sturdy construction and can be stacked, one atop the other.

The welders are designated WD30AE and WD40AE. An im-

Motor-generator welder announced by the Welding Department of the General Electric Co.

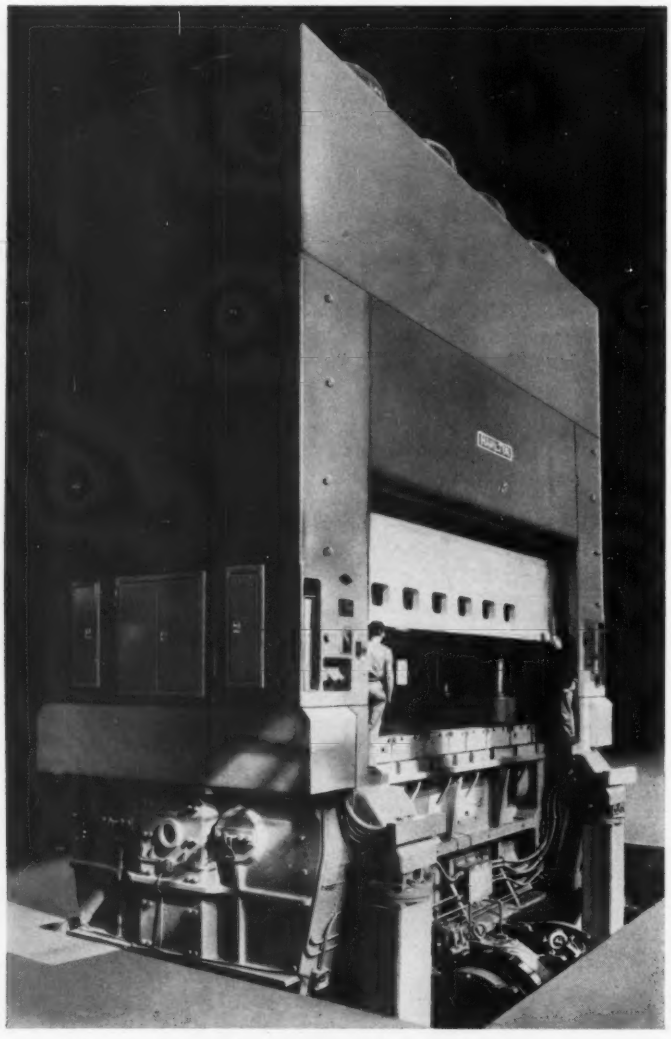
proved magnetic starter with fast response, bimetallic thermal overload relays prevents motor burnout in the event of motor overload. All bearings, which are rubber-mounted for quiet operation, are over-size. A unique air by-pass in the intermediate bearing housing and a dust cap on the commutator and bearing keep out dust.

Built with push-button controls, the new units include generator, driving motor, and controls enclosed in a weather-resistant, ventilated case. They can be used for virtually all industrial applications, including light, medium, and heavy direct-current metal arc and inert arc welding.

Circle Item 109 on postcard, page 241

Huge Triple-Action Presses Anticipate Demands for Larger Stampings

Two huge triple-action presses—the largest ever built—are now in operation in the Chicago Heights stamping plant of the Ford Motor Co. With bolster and blank-holder dimensions of 200 by 100 inches, it is expected that these presses will handle body stampings as large as any likely to be specified in the design of future automobiles. The presses, built by the Hamilton Division (Hamilton, Ohio) of the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa., feature bottom-drive construction. This permits both upper slides to be pulled down by slightly stretchable rods, allowing production of stampings of slightly varying thickness without blank-holder adjustment.



Gigantic, triple-action Hamilton press built by the Hamilton Division of Baldwin-Lima-Hamilton Corporation

All controls—mechanical, electrical, and pneumatic—are confined within the press framework. This allows quick, easy initial installation and provides for maximum operator safety, as well as easy operation and maintenance. Correct slide-timing is assured by mechanically synchronized actuation of all three slides from a single main drive. Air or electrical failure will not affect synchronization, and breaks in timing are impossible in the triple-action Hamilton single-drive system.

Eddy current clutches and electrical brakes provide for variable-speed operation at optimum speeds during each portion of the cycle—fast for non-productive portions when advancing to and returning from the work, slow for the work portion.

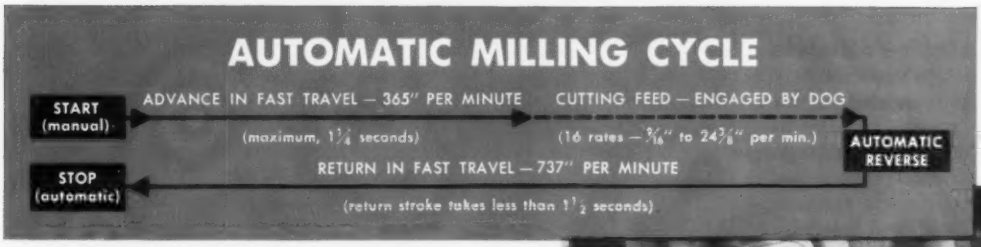
Positive lubrication of all moving parts is assured by an automatic system—the lower operating mechanism by circulating oil and minor parts by a centralized grease arrangement.

Sequencing of the three actions consists of pulling down 800-ton blank-holder and holding the blank; pulling down 800-ton inner (upper) slide and making a draw; and pushing up 550-ton lower slide, performing reverse forming or blanking operation. These presses are operated a a speed of nine strokes per minute. The main drive is a 250-H.P. motor. Most of the operating mechanism—integrated into the lower part of the press below the main floor level—is conveniently accessible from the basement for inspection and maintenance. This bottom-drive construction affords a compact installation requiring only 19 feet of headroom and an 17-foot basement. The inner slide is 188 by 80 inches and the lower slide, 192 by 71 1/2 inches.

Circle Item 110 on postcard, page 241

(This section continued on page 204)

The BROWN & SHARPE No. 000 – with the


AUTOMATIC MILLING CYCLE
START (manual)
ADVANCE IN FAST TRAVEL – 365" PER MINUTE
(maximum, 1¼ seconds)
CUTTING FEED – ENGAGED BY DOG
(16 rates – 3/16" to 24 3/8" per min.)
AUTOMATIC REVERSE
STOP (automatic)
RETURN IN FAST TRAVEL – 737" PER MINUTE
(return stroke takes less than 1½ seconds)

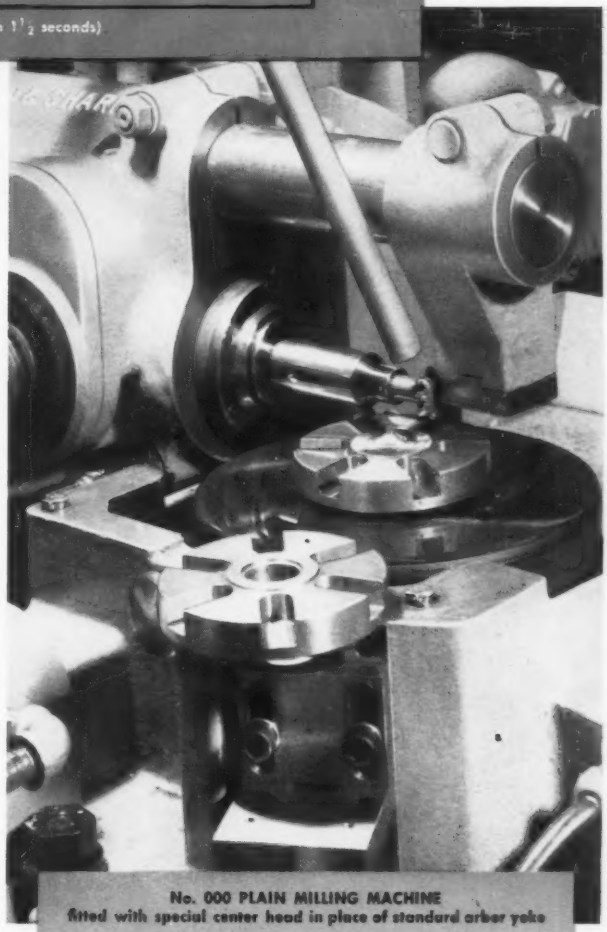
Special machine productivity with unlimited adaptability

Set up with conventional work-holding equipment, the Brown & Sharpe No. 000 Plain Milling Machine is the reliable pace-maker for rapid production milling of small parts.

For exceptionally long runs, fixtures of special design further increase the basic high-production potential of the No. 000. Such fixtures provide automatic indexing, continuous loading with automatic clamping, and other forms of automation, with record savings in milling cost.

With a special fixture on a standard machine, you get the high-speed production advantages of an expensive single-purpose special machine. You save on equipment cost and you avoid the risk of costly obsolescence due to later changes in product design. The unlimited adaptability of the basic machine permits easy conversion to revised operations, or other jobs.

Brown & Sharpe specialists in fixture design will survey your operations and make recommendations at your request. Let them show you how to make your investment in production milling equipment pay the highest return in savings. For complete information, write: Brown & Sharpe Mfg. Co., Providence 1, R. I.



No. 000 PLAIN MILLING MACHINE
fitted with special center head in place of standard arbor yoke

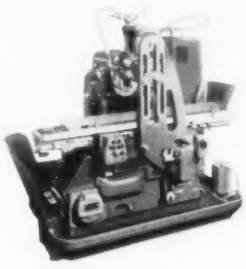
SPECIAL AUTOMATIC INDEXING FIXTURE
Operator loads fixture and starts machine. Cycle continues until final cut . . . then machine stops automatically.

Cutter **— Special carbide-tipped angular milling cutter 1¼" dia.—held in special collet**
Part **Turret indexing plate** ***Material*** **C1120 Steel**
Operation **Mill 83 radial notches on face of hub**
Cutter Speed **835 rpm** ***Feed Rate*** **24⅜" per min.**
Production 10 PIECES PER HOUR

Heavier production units powered for the larger work size range

No. 12 PLAIN MILLING MACHINE

3, 7½, or 10 HP Spindle Drive



The home of PRECISION CENTER

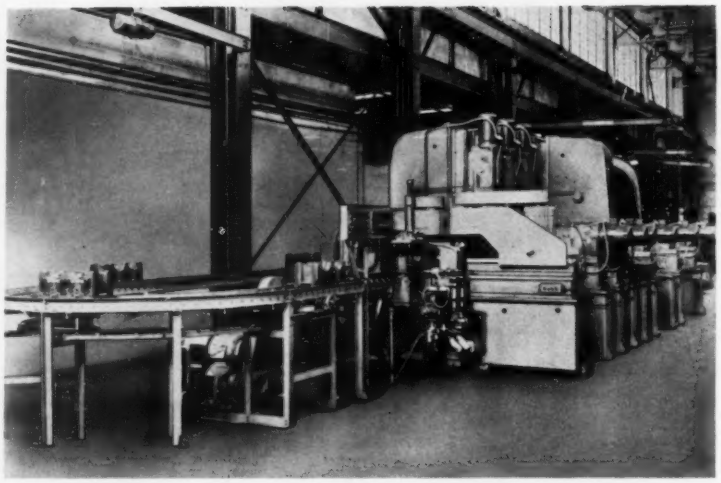
Brown & Sharpe

MILLING, GRINDING, AND SCREW MACHINES • CUTTERS
MACHINE TOOL ACCESSORIES • PRECISION TOOLS • PUMPS

Avey Transfer Machine for Processing Pump Covers

The Avey Drilling Machine Co., Cincinnati, Ohio, has recently built a transfer machine which automatically rough-and finish-mills, drills, countersinks, and taps 360 hydraulic pump covers per hour. Operations include automatic gaging, probing, and insertion of a bronze bushing in a bore. The operator loads two parts on each platen type fixture, which is automatically clamped, unclamped and returned to the loading position.

Circle Item 111 on postcard, page 241



Pump-cover processing machine built by the Avey Drilling Machine Co.

Tapping and Drilling Machine

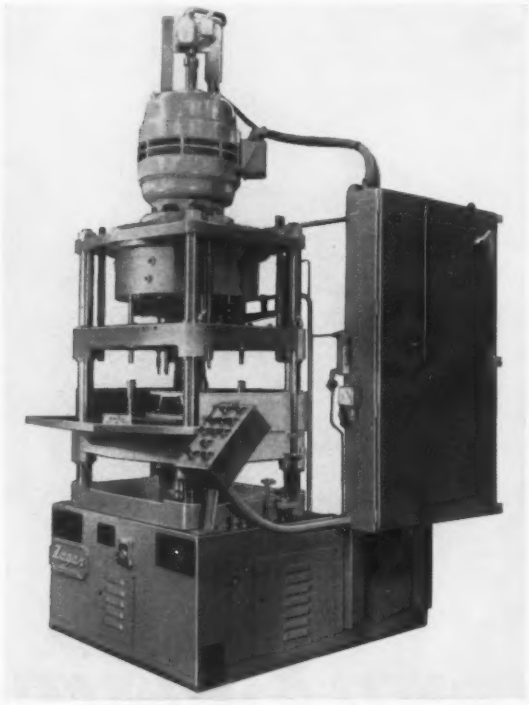
Zagar, Inc., Cleveland, Ohio, has announced that tapping can be combined with drilling and reaming in its four-post machines previously designed for the latter operations only. The drill head with its fixture equipment is removed to accommodate the lead-screw tapping head. Small production runs with changeable hole patterns, as well as various operations, can be economically tooled.

The four-post principle developed by Zagar involves a hydraulically actuated ram which raises the work and feeds it into the rotating spindles of the head. All holes are machined simultaneously. The design is said to lend great rigidity to the machine and afford long drill life. Holes as close together as the sum of the hole diameters can be either drilled or tapped. This machine is standardized in the 32-inch size.

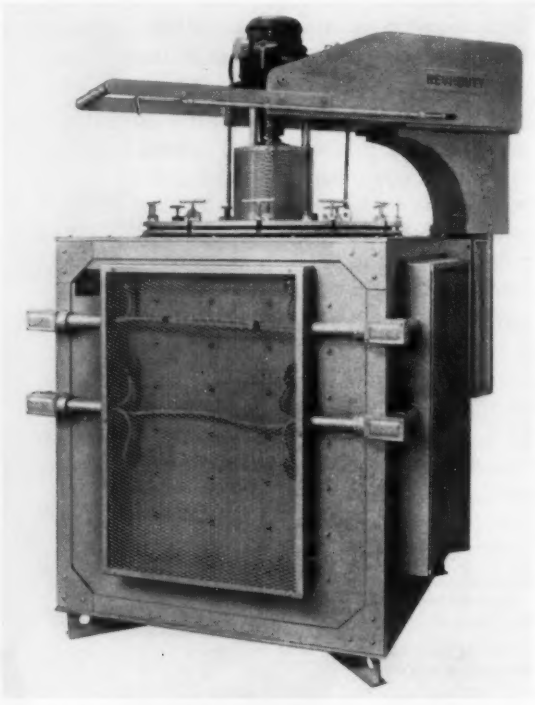
Circle Item 112 on postcard, page 241

"Versa-Duty" Pit Furnace

The Hevi-Duty Electric Co., Milwaukee, Wis., has announced a "Versa-Duty pit furnace for use with or without a protective at-

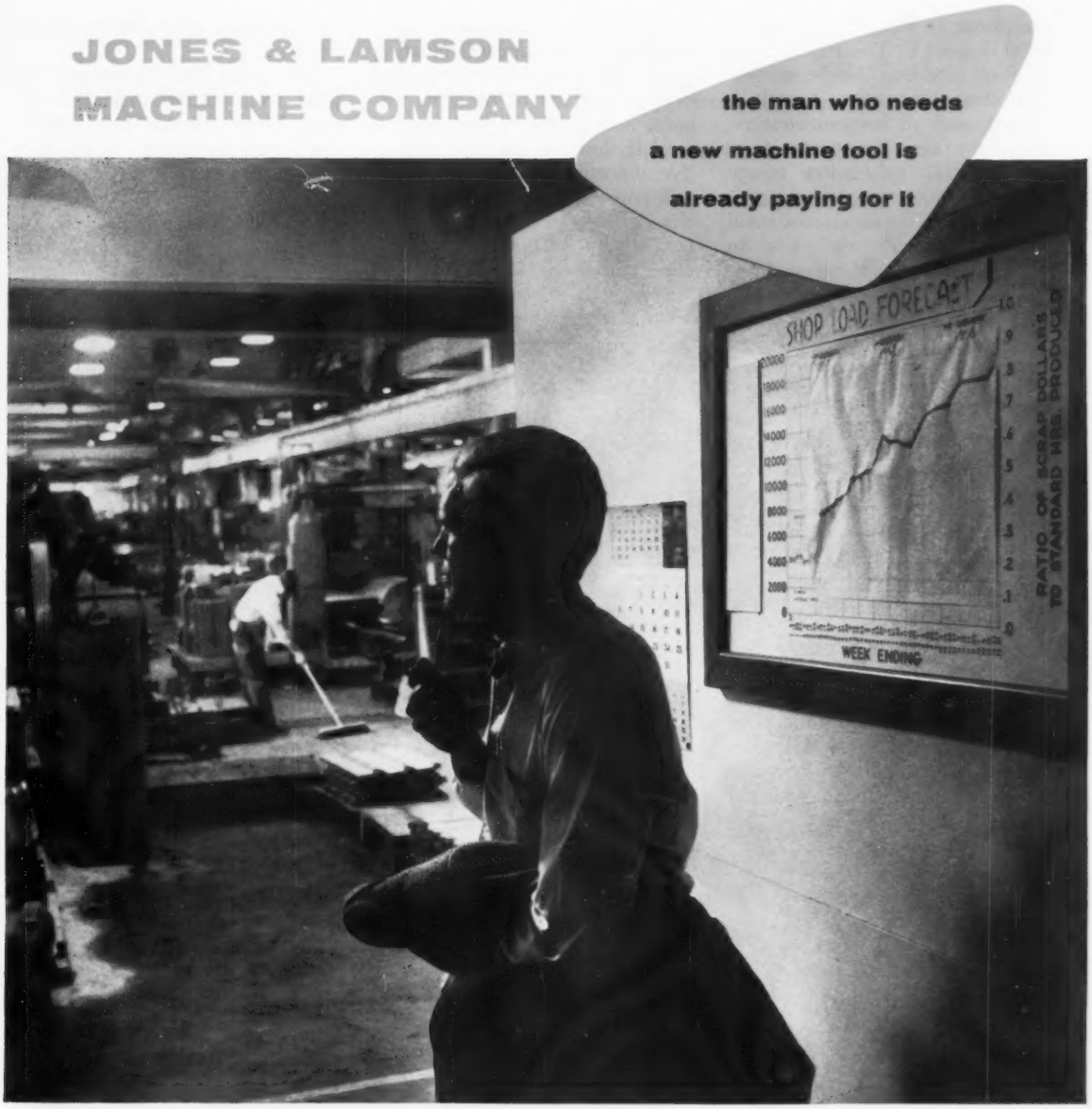


Zagar four-post machine equipped for tapping, drilling, and reaming



Versatile "Versa-Duty" pit furnace announced by the Hevi-Duty Electric Co.

JONES & LAMSON MACHINE COMPANY


the man who needs
a new machine tool is
already paying for it
SHOP LOAD FORECAST
WEEK ENDING
RATIO OF SCRAP DOLLARS TO STANDARD HRS. PRODUCED

There's no time like the future

There just isn't any way of predicting the "when" or "whence" of future orders. Things happen fast nowadays, and twists of fortune can transmute production dreams into nightmares in a twinkling.

There's one thing sure about the future, though, and we can all bank on it: tomorrow, next year and ten years from now, the competitive edge will be held by those who are equipped to turn out the best possible products at lowest possible cost.

The most advanced machine tools and methods are nothing less than *a vital requisite of survival*. Good sense, therefore, dictates that you keep abreast of the latest developments in production.

We'd like to help you do just that. Liberal finance plans are available.

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools • Thread & Form Grinders

mosphere at temperatures up to 1450 degrees F. This furnace will perform nitriding, bright-tempering, steam-tempering, annealing, bluing, and all low-temperature, non-atmosphere heat-treating operations with only minor equipment changes.

A high-speed fan assures rapid heating in the densest loads. An alloy baffle directs the flow of the hot gases for uniform penetration in all parts of the work basket. Large volumes of parts can be treated in baskets or fixtures with a minimum amount of handling necessary.

Where a protective atmosphere is required, a gasket-sealed retort effectively seals out contaminating gases. The retort and cover assembly can be removed from the furnace, and another retort can be used if slow cooling in a protective atmosphere is desired. Work will come out clean and bright, eliminating further grinding or cleaning operations.

The larger models feature motor-operated cover lifts and the "Return Bend" heating elements. In the smaller furnaces, "multiple unit" elements and hand-operated cover lifts combine ecomomy with versatility.

Circle Item 113 on postcard, page 241

Snyder Special Transfer Machine for Processing Automotive Parts

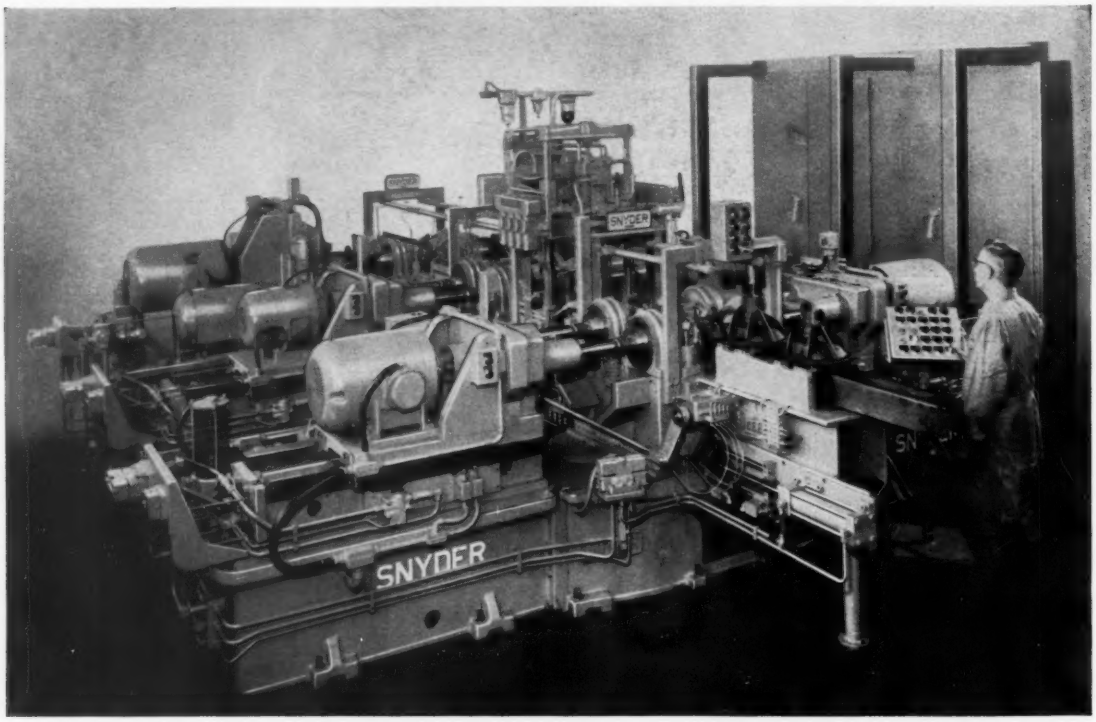
An in-line segmented special transfer machine for boring and tapping automotive differential carrier and cap assemblies has been designed and built by the Snyder Tool & Engineering Co., Detroit, Mich. This seven-station machine performs bolt loosening and tightening operations designed to relieve stresses between rough- and semifinish-boring operations. It is hydraulically operated and electrically controlled. The machine rough-bores two carrier bearing holes, loosens and tightens four bearing cap bolts, semifinish-bores the two bearing surfaces, and taps each bearing at a net production rate of 180 pieces per hour.

The parts are transferred in pairs from station to station on rails by a transfer mechanism. Two parts are machined in each station, the carrier bearings being individually bored by dual spindles in slide units on each side of the machine.

After the two 3 1/4-inch diameter carrier bearing holes in two parts are rough-bored in the second station, they are transferred to the third station, where the bearing cap bolts are loosened and retightened by air wrenches. During the bolt loosening and tightening operations, each part is held in position on the transfer rails by air-powered clamping devices.

The bearing holes in two parts are semifinish-bored to a tolerance of 0.002 inch in the fourth station. Two large-diameter threads are machined in each bearing bore in the sixth station. Finish-machined parts are unloaded in the seventh station. The machine occupies a floor space of about 160 by 228 inches.

Circle Item 114 on postcard, page 241
(This section continued on page 208)



Snyder segmented transfer machine for processing differential case and bearing cap assembly

JONES & LAMSON
THREAD TOOLS

the man who needs
a new machine tool is
already paying for it

Rapid Inspection Between Operations Keeps Quality High, Scrap Low

Things start to happen when J & L Optical Comparators are put to work on production line inspection. Parts — even the most intricate ones — are inspected more easily and more rapidly than ever before. Measurement is precise to .0001". Parts which undergo several operations are speedily checked *at each stage* of manufacture. Any errors present in production operations are instantly revealed.

As a result of all this, production flow is faster and surer, product quality is kept on a higher level, and *scrap* volume takes a nose dive.

Investigate the possibilities that lie in using J & L Optical Comparators in *your* manufacturing. Send for our latest Comparator Catalog. JONES & LAMSON MACHINE COMPANY, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools • Thread & Form Grinders

Fig. 1. Micromatic honing machine for microhoning outer ring raceways for ball bearings

Multiple-Spindle Machines for Microhoning Raceways for Ball Bearings

Both inner and outer raceways for ball bearings are now being microhoned on a new line of automated multiple- spindle machines developed by the Micromatic Hone Corporation, Detroit, Mich. This is claimed to be the first successful development for automatic processing and handling of raceway rings on multiple-spindle machines.

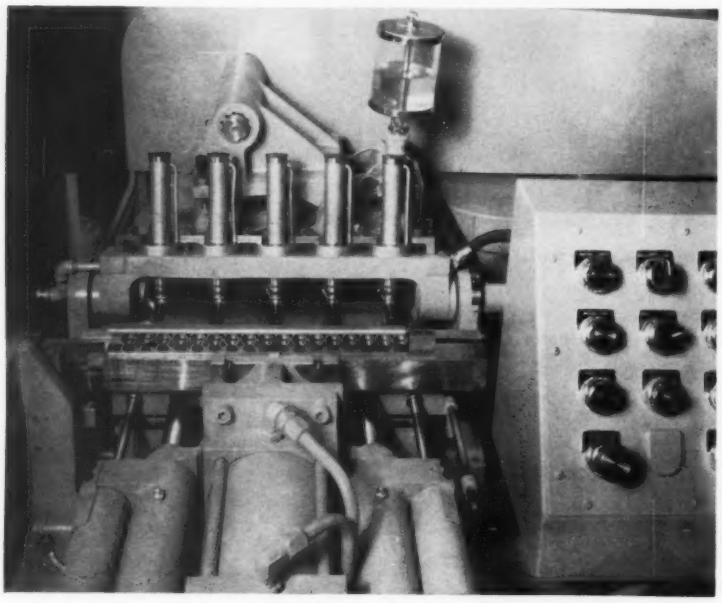


Fig. 2. Close-up view of Micromatic honing machine equipped for finishing inner ring raceways

The machines are designed with either three or five spindles, depending on the bearing size. The entire operation is automated—including automatic loading and ejection, automatic cycling, and automatic feeding of the abrasives—and the machine stops when the abrasives require replacing.

Examining the results obtained by various methods of finishing the ball tracks with three newly designed laboratory instruments facilitated the development of the new machines to give the desired results.

Tapered arbors are used for the small inner rings, as shown in Fig. 2, and end-clamping arbors for larger sizes. The parts are pressed on the arbor and then pulled against a plate that locates them in correct relation to the microhoning tools or abrasive sticks. The microhoning tools are mounted on an oscillating bridge that pivots about the true center of the raceway arc. As the ring rotates, the abrasive sticks sweep across the tracks removing all irregularities.

During the major portion of the timed cycle, the bridge oscillates rapidly to give full coverage of the raceway and to remove stock rapidly. The speed of oscillation is then automatically reduced, so that the finished track has all abrasives marks running circumferentially around the track.

Outer rings are held in chucks that locate them from the outside diameter and clamp them on the side faces. The motions and cycling are the same as for the inner rings. Production on a five-spindle Microhoner finishing No. 8 inner bearings is 500 rings per hour. Using three spindles for the outer rings of the same bearing, production is 240 parts per hour. This will vary with the size of the bearing and the condition of the rings when they come to the machines.

Circle Item 115 on postcard, page 241

(This section continued on page 210)

JONES & LAMSON
OPTICAL COMPARATORS

the man who needs
a new machine tool is
already paying for it

J & L Revolving Tangent Die Heads Give Long-Run Economy, Guaranteed Accuracy

The efficiency of your threading operations rises sharply when you use J & L automatic opening Tangent Die Heads. Revolving types, similar to that illustrated, are available for multi-spindle automatics, drill presses and special machines.

Chasers are changed in mere seconds, without disturbing the die head *or chaser holders;* repetitive tripping permits automatic threading close-to-shoulder; one set of holders handles a full range of coarse, fine and multiple pitches; you get up to 30 foolproof resharpenings with every set of chasers. *And* Class III threads are guaranteed... *every time!*

J & L manufactures complete lines of die heads and chasers; accessories and sharpening equipment; collapsible and solid adjustable taps and chasers; the "Modern-Magic" chuck and automatic releasing stud setters. Send for Thread Tool Catalog. JONES & LAMSON MACHINE COMPANY, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools • Thread & Form Grinders

For more information fill in page number on Inquiry Card, on page 241

Kodak contour projector provided with micrometer device for horizontal measurements

Combined boring and spot-facing tools with throw-away inserts developed by the Wesson Co.

Contour Projector with Micrometer Gaging Device

A Kodak contour projector, Model 14-6, which embodies a micrometer device for horizontal measurements, has been announced by the Eastman Kodak Co., Rochester, N. Y. This projector has ample table travel to simplify staging the work and is especially adapted for inspection.

A movable work-table with both horizontal and vertical traverse is included as standard equipment. The horizontal measurement device available with the projector, in combination with the high-contrast viewing screen, makes possible magnified micrometric measurements for toolroom optical gaging.

Circle Item 116 on postcard, page 241

Variable-Speed Regulator for Machine Drives

A dual-circuit, variable-speed electronic regulator for application in continuous-process manufacturing operations has been developed by Reliance Electric & Engineering Co., Cleveland, Ohio. This regulator, designated VSMR, is designed for drives on machines requiring the control obtainable only through the use of electronic equipment capable of giving the utmost continuity of performance, such as required in industries manufacturing non-ferrous metal, paper, rubber, and glass products. The regulator is available in both 6- and 10-ampere output sizes.

Circle Item 117 on postcard, page 241

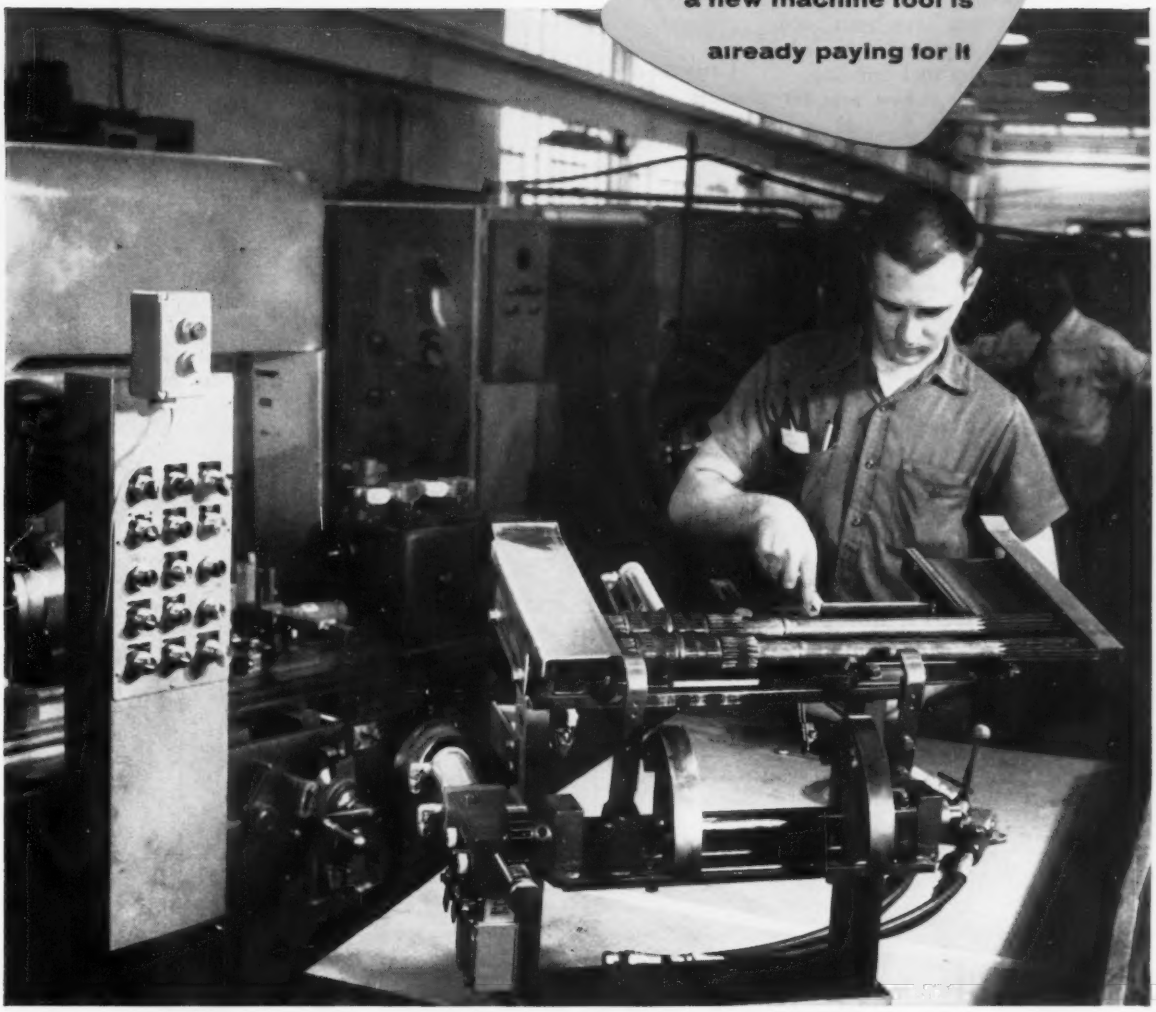
Wesson Combined Boring and Spot-Facing Tools

Combined boring and spot-facing tools with throw-away blanks for both operations are now available from the Wesson Co., Detroit, Mich. The dial-head adjustment screw for the boring blank is calibrated so that each graduation is equal to 0.001 inch on the diam-

Reliance electronic regulator for machine drives

JONES & LAMSON FORM GRINDERS

the man who needs a new machine tool is already paying for it



Full Versatility to Suit Your Needs... Both Manual and Automatic

By using the automatic handling device shown above, a J & L Model E Form Grinder can handle 113 pieces per hour. Four grinding wheels plunge grind in one operation, to very close tolerances.

Other Model E's along this assembly line are equipped for crush wheel, or diamond trueing; automatic or manual handling; chucking work, center work or shoe-type support, depending on the work to be done.

This is an example of how plunge form grinding is being used in many plants to perform a great variety of work. Its superiority over other methods offers great benefits, in terms of versatility, accuracy and speed. Learn how J & L Form Grinders can help improve *your* production.

Write for Form Grinder Catalog, JONES & LAMSON MACHINE COMPANY, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools • Thread & Form Grinders

eter. Once adjusted, there is usually no need for any further resetting of the tool. When one edge is dulled, the blank is merely indexed to a new cutting edge. Correct location is automatic. When all edges have been used, the blank is replaced by a new one, eliminating tool grinding.

Circle Item 118 on postcard, page 241

Rotex Vertical Milling Machine

A vertical milling machine, designated Model VM, has just been placed on the market by the Rotex Punch Co., San Leandro, Calif. Special features of the machine include: all-angle vertical head; table with ground surface and 1/2-inch T-slots milled from solid; large, easy-reading dials; and convenient, heavy-gage storage cabinet with able space for accessories.

The table has a working surface 5 by 20 inches and a longitudinal feed of 12 inches. There are five spindle speeds ranging from 390 to 5200 R.P.M., which can be easily interchanged.

Circle Item 119 on postcard, page 241

Universal Positioning Table

A universal positioning table capable of reproducing any pattern of holes within a 10 1/2 by 12-inch rectangle has been announced by Howe & Fant, Inc., East Norwalk, Conn. This table is intended for use with the Howe & Fant turret drilling and tapping machine but can also be employed on single-spindle drill presses and radial drills.

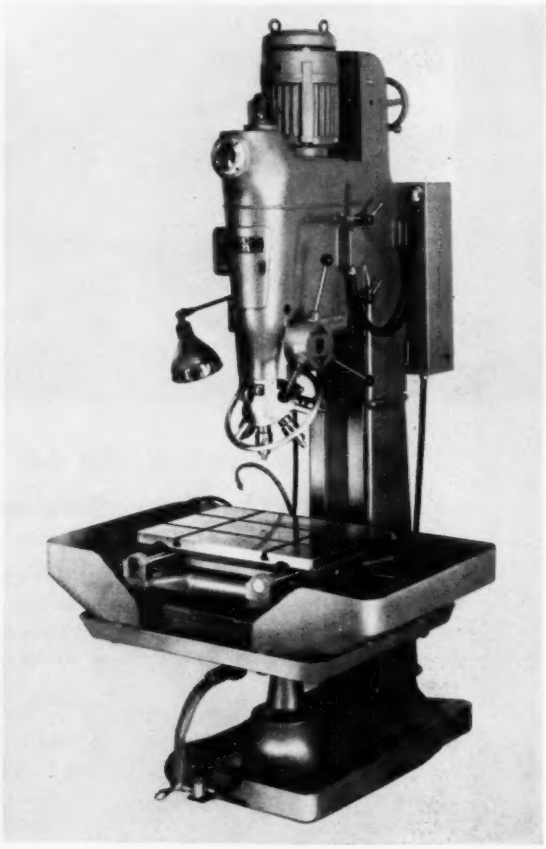
Like the earlier 3- and 6-inch positioning tables, the new larger table is designed for general purpose use, the only part that is special for any given job being the hole-location plate which carries the pattern of holes to be drilled.

The table is easily set up and can be changed from one job to another simply by substituting a new hole-location plate. This can be accomplished in about 15 minutes. Simply depressing a foot-operated air valve (other types of valves optional), causes a hardened tapered locating pin to withdraw from a tapered hole in the location plate. The table is then moved manually to the approximate location for the next operation, at which point the air-actuated tapered pin automatically enters another tapered hole, pulls the table into accurate alignment with the machine spindle, and locks it there.

Table movement is virtually friction-free, due to sealed ball bushings, riding on hardened rails. Maximum vertical deflection under load is 0.002 inch, and the table will consistently return to its locating position within a total variation limit of 0.001 inch.

Circle Item 120 on postcard, page 241

Vertical milling machine made by Rotex Punch Co.



Howe & Fant universal positioning table

JONES & LAMSON "AUTOMATION"

the man who needs a new machine tool is already paying for it

This tape-controlled table eliminates set-up time on small lots

It's natural enough, in a way, to associate "automation" with huge plants and their long, high-speed production lines.

We should also keep in mind, however, that certain "automation" techniques offer tremendous benefits to the *small job shop*. Jones & Lamson research and development have produced remarkable results in applying "automation" to small-lot production.

Are you interested in drastically cutting set-up and change-over time, and greatly increasing your small-lot flexibility? We'd be pleased to show you how the results of our intensive research and development programs can be put to good use in *your* operations.

Write for literature. JONES & LAMSON MACHINE COMPANY, 512 Clinton Street, Springfield, Vermont.

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For more information fill in page number on Inquiry Card, on page 241

"Connecticut" band saw made by W. Whitney Stueck, Inc.

"Connecticut" Band Saw

W. Whitney Stueck, Inc., Old Saybrook, Conn., has introduced a "Connecticut" band saw of the friction cutting blade type for cutting mild steel, stainless steel, and hardened steel up to 1/4 inch thick. This band saw is said to cut exceptionally fast and to produce work having smooth, accurate edges with a minimum of burr. The band saw is available in three models having different speeds for cutting a variety of materials.

Circle Item 121 on postcard, page 241

Sheffield Electronic Gages, Comparators, and Recording Timers

The Sheffield Corporation, Dayton, Ohio, has recently announced precision measuring and timing equipment covering a wide field of applications. One of the developments is an electronic internal calibrating master, Fig. 1, which is adjustable over a range from 5 to 36 inches and available with a dual electronic amplification of either 1000/2000; 2500/5000; 5000/10,000; or 10,000/20,000 to 1. Amplification within each dual range on the Sheffield "Accutron" electronic amplifier can be switched from one to another without realignment of the indicating meter mechanism. The gage operates on 110-volt, 60-cycle, alternating current, and the high-speed readings are unaffected by line voltage fluctuations from 65 to 150 volts.

The Sheffield "Monitorecord," shown in Fig. 2, is a portable instrument for timing and recording as many as fourteen simultaneous machine operations or sequences. It provides a visual record of automatic equipment sequential timing to an accuracy within one hundredth of a second. This instrument will operate on the electrical control circuit of any automatic machinery, transfer, assembly, gaging, and inspection equipment while it is running and enables maintenance personnel to quickly spot faulty cycles and out-of-adjustment units.

Fig. 1. Sheffield electronic internal calibrating master gage

Fig. 2. "Monitorecord" developed by Sheffield Corporation

The Sheffield electronic "Accutron" comparator, not shown, is another device designed for precision measurement and inspection in the shop, toolroom, and gage laboratory. It is available with standard dual amplifications of 1000/2000; 2500/5000; 5000/10,000; 10,000/20,000; or 20,000/40,000 to 1. Amplification within each dual range can be switched from one to another without realigning the indicating meter mechanism. The gage head is adjustable vertically over a range of 6 inches. A Sheffield "Electrojet" transducer type gage cartridge is used for size-sensing.

A four-column "Precisionaire" pneumatic gaging assembly for checking two outside diameters, the inside diameter, and the overall length of a transmission ring gear simultaneously has been added to the line of Sheffield gear-gaging equipment. Plunjet gaging cartridges are used as the size-sensing elements.

Circle Item 122 on postcard, page 241

Radius-Cutting Machine

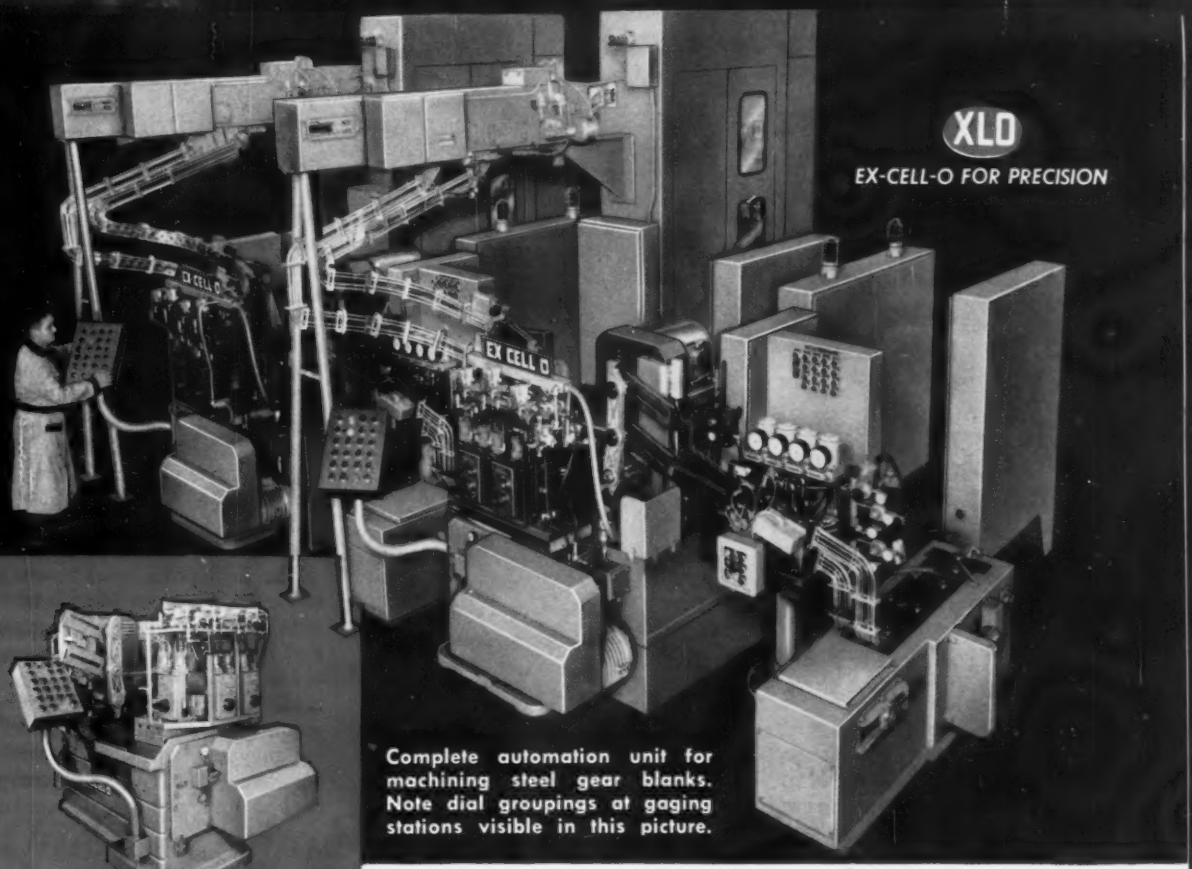
The Special Machinery Co., Inc., Winsted, Conn., is manufacturing a radius-cutting machine that can be easily operated and adjusted by unskilled labor. It is designed to cut a radius on the end of square, rectangular, flat or round material, including ferrous and non-ferrous metals, of any size up to 1 1/4 inches thick by 2 1/2 inches wide.

(Continued on page 216)

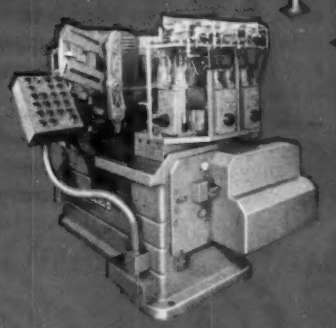
Radius-cutting machine made by Special Machinery Co., Inc.

XLD

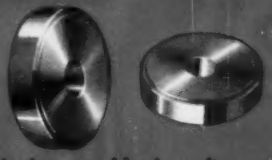
EX-CELL-O FOR PRECISION



Complete automation unit for machining steel gear blanks. Note dial groupings at gaging stations visible in this picture.



Ex-Cell-O Style 312 Cam Boring Machine adapted for automation. Components on cross slide automatically adjust tools to hold specified limits.



Typical gear blanks after automatic machining is completed.

Standard Ex-Cell-O Machines Handle Automatic Operations

Take these cam boring machines, for example: they are standard Ex-Cell-O 312s. When a customer's production schedule called for an unusually high per hour output of steel gear blanks Ex-Cell-O engineers incorporated these machines into an automated setup.

Included in the new setup: two cam-operated Ex-Cell-O Precision Boring Machines, two Gear-O-Mation storage-distribution units, three gaging stations.

The boring machines finish all the surfaces of the gear blanks: face both sides, chamfer both inner and outer edges, bore the central holes and turn the outside diameters. Tools are adjusted automatically to maintain required tolerances. Gage units automatically check parts prior to entering the machining stations, and the storage-distribution units provide space for a bank of parts at each machine station.

If you're interested in automation, but are held back by the high cost of specially designed machine tools, call your nearby Ex-Cell-O Representative today. Perhaps a standard Ex-Cell-O machine tool setup can be adapted to your automatic operation requirements. Or, if you prefer, contact Ex-Cell-O in Detroit directly.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

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57-21

No setup time is required—all the operator does is insert workpiece into vise of machine, set gage for radius to be cut, adjust slide, clamp work securely, and start cutter. Chips are drawn through a hollow-spindle housing and ejected through a chute into chip pan at rear of machine by means of a blower.

Circle Item 123 on postcard, page 241

Circulating Lubricating Oil System

The Farval Corporation, Cleveland, Ohio, has announced the development of a new type of circulating lubricating oil system to be marketed under the trade name "Lubrival." This system is designed to serve the lubrication needs of presses and automatic and semi-automatic machine tools. It employs the regular Farval two-line principle of operation to supply oil under pressure to "Progressive Dualine" measuring valves for delivery to bearing points. The valves have individual sight indicators and feature the positive piston displacement method of feeding lubricant. A pressure sensing mechanism warns of clogged or broken lines.

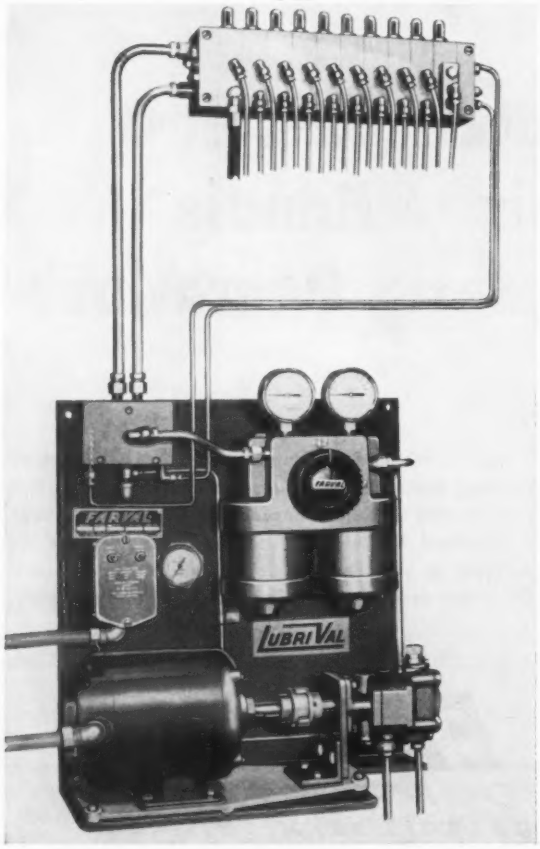
There is no limit to the number of measuring valves that can be manifolded together to serve a piece of equipment. The valves are manufactured in two capacities for interchangeable installation, as required. The equipment layout includes a manifolded group of "Progressive Dualine" measuring valves, shown at top of accompanying illustration, connected to the reversing valve on control panel. Other components include a high-low pressure switch, reservoir level indicator, 1/2-H.P. motor, variable-delivery pump, and high-pressure twin filter. Reservoir and return oil arrangements are determined by the equipment builder or user.

Circle Item 124 on postcard, page 241

Radial Drill Presses

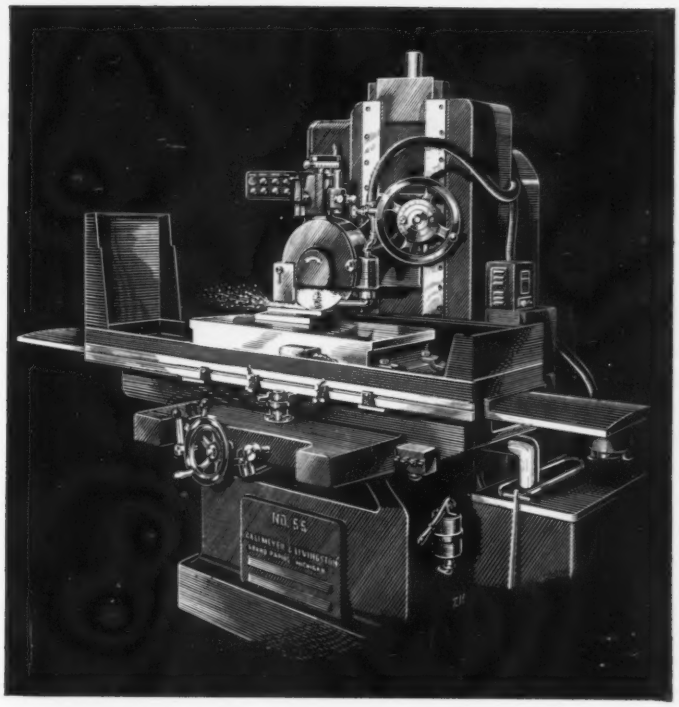
An improved line of radial drill presses developed to match the ruggedness, versatility, and general performance characteristics of heavier machine tools has been introduced by the Walker-Turner Division of the Rockwell Mfg. Co., Pittsburgh, Pa. These machines simplify operations by making it unnecessary to move jigs and other mounting fixtures. Some twenty-four models are available with a spindle travel of either 4 1/4 or 6 inches and a column length of 30 inches or a special length of 42 inches.

The drill press head moves in and out through an 18-inch travel radius on a smooth traveling ram that permits drilling to the center of a 62-inch circle. Head, ram, and cradle swivel a full 360 degrees around the column to permit drilling anywhere on the table (which has four T-slots and an oil trough tapped to accommodate coolant



"Lubrival" oil system for machine tools

Walker-Turner improved radial drill press



Questions you should ask before you buy a

SURFACE GRINDER

- Are column and base *one piece* for permanent, vibrationless rigidity?
- Are both longitudinal table travel and cross feed hydraulically actuated?
- Is the wheel head powered for rapid vertical travel?
- Is it equipped with Vickers vane type hydraulic pump?
- Is the longitudinal table capable of speeds up to 125 fpm?
- Is it equipped with greased-for-life, pre-loaded ball bearing spindle?
- Does the wheel head have 18 inches of vertical movement?
- Is the spindle capable of speeds of 1925 and 2500 rpm?
- Does it have a 12" x 36" table working surface?
- Is it equipped with Bijur one-shot lubricating system?

You'll Choose Grand Rapids Grinder, No. 55 because it's the only grinder of its type that answers an emphatic "yes" to every one of these ten important questions.

Write for 24 page book that tells all about it.

GALLMEYER & LIVINGSTON

GALLMEYER & LIVINGSTON COMPANY

305 Straight Ave., S.W., Grand Rapids, Michigan

For more information fill in page number on Inquiry Card, on page 241

piping) or on work that must be kept on the floor. The head tilts 45 degrees and locks on both sides to prevent angle deviation under heavy loads. Also, it can be raised and lowered rapidly.

A built-in ball bearing jackshaft assembly provides 15 full-power speeds ranging from 160 to 8300 R.P.M. with a motor having a speed of 1740 R.P.M. Sanding drums, tapping heads, chip-breaker, multiple drills, mortising attachments, and most other attachments used on standard drill presses can be employed. The machines are especially suited for rapid precision drilling of large or heavy stock, sheet stock, panels or plywood since several widely separated holes can be drilled without moving the work. The cast-iron table is 26 by 18 inches. A one-piece head and ball-bearing construction permits the ram to roll effortlessly on eight precision ball bearings mounted in a rugged supporting cradle. A ball thrust bearing on the column support collar facilitates swinging of head, ram, and cradle.

Circle Item 125 on postcard, page 241

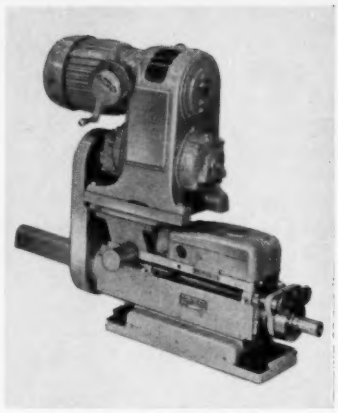


Fig. 2. Morris Air-Oil-Matic drill unit equipped for gun-drilling

Morris Two-Way Drilling Machine and Air-Oil-Matic Drill Units

A two-way drilling machine, Model 350-S, Fig. 1, manufactured by the Morris Machine Tool Co., Cincinnati, Ohio, is designed to drill two, five, or six equally spaced holes arranged in a circular part. Selection of the number of holes to be drilled is achieved automatically, eliminating change-over time.

Two Morris Air-Oil-Matic drill units and an air-operated indexing fixture are the basic components of the machine. They are interlocked in a variety of automatic-cycle combinations to drill the number of holes required. For instance, to drill two holes, the index selector switch on the control panel is set accordingly and the part is loaded. When the cycle-start-button is pressed, both units drill, retract, and stop.

For six holes, both units drill and retract, and the fixture indexes in three continuous operation sequences before the cycle stops. The left-hand unit is automatically inoperative when the selector switch is set at five holes. The operation then consists of one unit drilling and retracting, and then fixture indexing, until five holes are drilled. The air-powered, hydraulically controlled Air-Oil-Matic drill units offer adjustable feed rate, feed stroke, and total stroke, with a wide range of spindle speeds. Drill sizes range up to 5/8 inch in diameter.

The Morris Air-Oil-Matic drill units are available equipped for automatic gun drilling as shown in Fig. 2. These units offer definite advantages in drilling: deep holes, 5/32 inch in diameter and up; shallow holes where straightness, size, and finish is crucial; and where speed necessitates a high rate of metal removal, and finish is not critical.

In gun-drilling, high-pressure coolant is forced through the drill to contact the work at the cutting head. Chips and heat are carried away by the coolant, resulting in faster and more accurate drilling.

Spindle speeds up to 8000 R.P.M. can be obtained by adjusting the handwheel on the motor of the unit. Likewise, feeds up to 40 inches per minute are possible, with infinitely adjustable feed stroke of 6 or 9 inches. The entire unit is adjustable on a sliding base available for a 6- or 9-inch movement. In these units, oil controls the feed, while air is utilized to power the stroke. Thus, fast actuation results, and the problem of heating up the oil is eliminated. Since the oil is not pumped for power, it remains at the same temperature and viscosity during a complete production run.

Circle Item 126 on postcard, page 241
(This section continued on page 220)

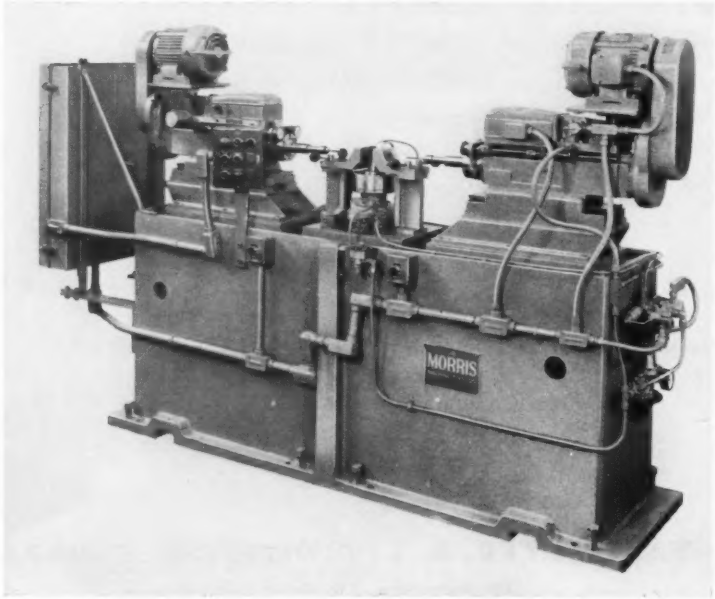


Fig. 1. Morris two-way drilling machine equipped with air-operated indexing fixture

XLO

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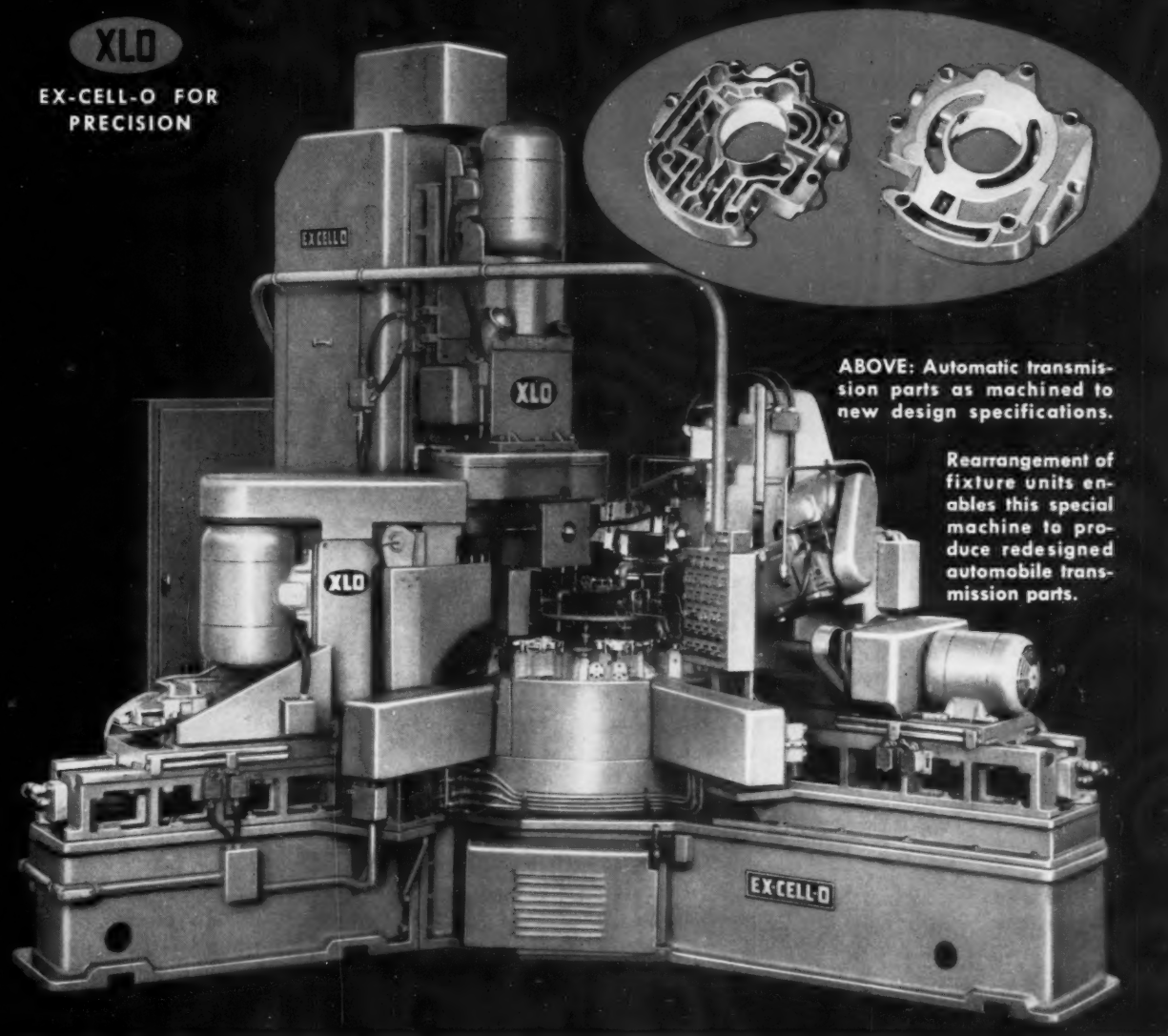

ABOVE: Automatic transmission parts as machined to new design specifications.

Rearrangement of fixture units enables this special machine to produce redesigned automobile transmission parts.

Parts changes didn't obsolete this special

Easily Adapted to Altered Workpieces

The first big parts change to come along will obsolete many a special machine—at a drastic cut into the production budget! But not so with this Ex-Cell-O special now operating at full tilt in an automobile plant in Detroit.

Built to process regulator valve bodies for automotive transmissions, this special machine was flexible enough to adapt to certain changes in tooling and operational cycles. Right now, it's turning out complicated parts at the rate of 120 per hour.

Machining includes fly-cutting both flat sides of aluminum part; drill and ream two piston holes; drill three angular holes; drill, ream and chamfer the top holes. Flatness of the two sides is an important requirement.

Ex-Cell-O specials have the extra precision you have come to expect of XLO products. Why not check with your Ex-Cell-O representative today? Or write Ex-Cell-O, Detroit.

EX-CELL-O CORPORATION *Machinery Division*

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57-26

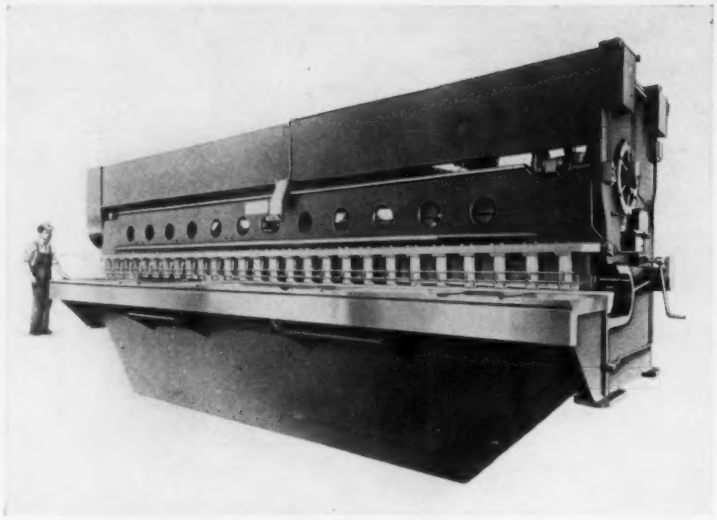
Steelweld Extra-Long Pivoted-Blade Shear

The longest pivoted-blade shear built so far by the Steelweld Machinery Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio, has just been completed. This machine, believed to be the longest ever made in this country, takes cuts 26 feet long in mild steel 3/8 inch thick at the rate of thirty strokes per minute.

Features of the machine include: all-welded, one-piece steel frame; air-operated clutch and brake; heavy, dependable, quiet-operating spring hold-downs; fast, easy Micro-set knife adjustment; electric foot-switch; and motor-operated back-gage with range of 48 inches.

The back-gage, push-button, and dial indicator are located at the front center of the machine. The blade counterbalance, as well as the hold-down, are air-operated and mounted inside the crown. The shear is arranged for slitting and notching, the slitting adjustment mechanism being mounted on the blade. The bed is 38 inches wide at top and extends 38 inches below the floor.

Circle Item 127 on postcard, page 241



Extra-long, pivoted-blade shear announced by the Steelweld Machinery Division of the Cleveland Crane & Engineering Co.

Hydraulic Contour Grinder with Tracer Control

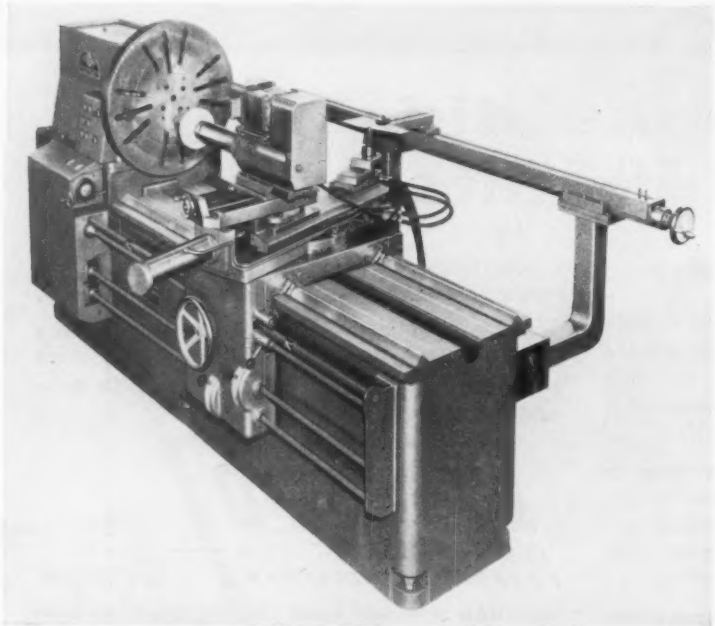
Intricate contours, both internal and external, can be ground with standard flat wheels dressed to very simple radii on a contour grinder recently developed by the Industrial Tool Engineering Co., Detroit, Mich. The variable-speed work-head of this machine facilitates polishing and buffing.

The problem of maintaining accurate contact between the tracer stylus and the template was solved by making provision for three angularity adjustments in a single swiveling unit.

With this combination of "angularity control" the new contour grinder will maintain precise contact pressure between the Turchan tracer stylus and the template. Thus, precise and automatic grinding of inside or outside contours becomes possible through the hydraulic tracer control. The tracer-slide and carriage are both driven by hydraulic tracer control.

The machine shown is of rugged steel and fine, cast-iron construction, has hydraulic power, and is equipped with a Turchan hydraulic tracer control. The headstock capacity range is from center to 39 inches on outside diameter work and, being equipped with heavy-duty bearings, will carry work-pieces weighing over a ton. The regular bed of the machine is 121 3/4 inches long and 24 inches wide, but the grinder can be built to customer's specifications. The spindle will take grinding wheels from 3 1/2 to 8 inches in diameter with spindle holes 1 1/4 inches in diameter.

Circle Item 128 on postcard, page 241



Contour grinder developed by the Industrial Tool Engineering Co.

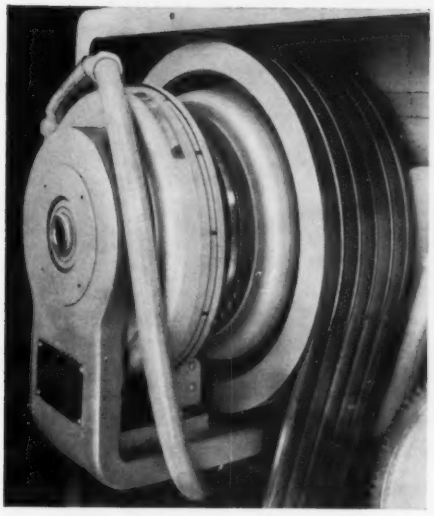


Fig. 1. Warner electric clutch and brake installed outside headstock of Nebel lathe

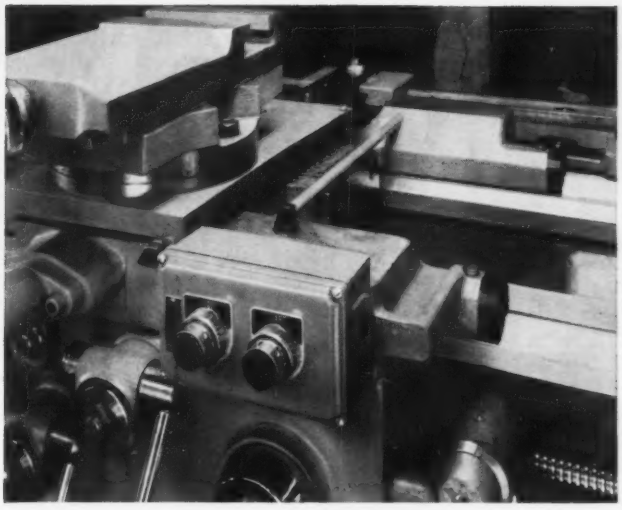


Fig. 2. Finger tip spindle start-stop control for operating Warner electric clutch and brake from lathe carriage

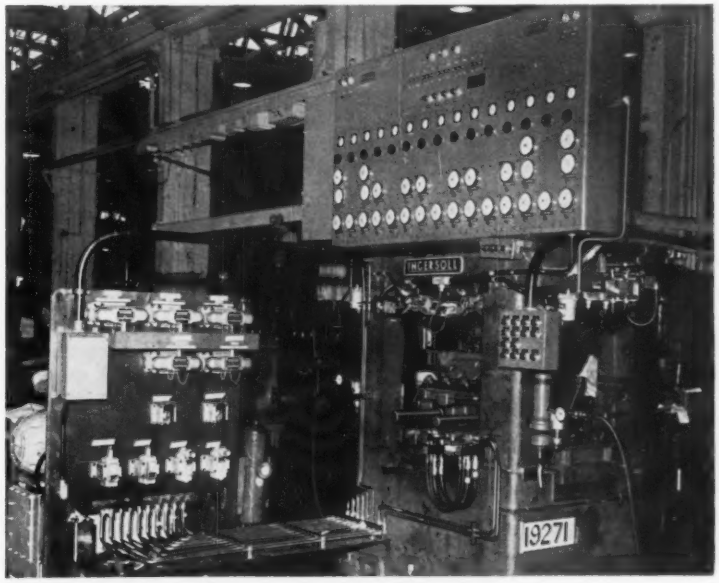
Warner Electric Clutch and Brake

The Warner electric clutch and brake is now available as extra equipment on all lathes manufactured by the Nebel Machine Tool Corporation, Cincinnati, Ohio. This starting and stopping equipment provides fast braking and requires a minimum of time for adjustments and take-up. Finger-tip control is by start-stop push-buttons accessibly located on carriage. The clutch and brake unit is located outside of the headstock housing for efficient dissipation of heat. Acceleration and deceleration rates are adjustable.

Circle Item 129 on postcard, page 241

Automatic Gage and Transfer Machine Designed for Engine-Block Line

A combination automatic gage and transfer machine that culls spoiled parts from an engine-block production line has been designed by the Ingersoll Milling Machine Co., Rockford, Ill. This machine makes twenty-five measurements without slowing down production and is capable of handling ninety-five engine blocks per hour. It checks five crankshaft bores and five camshaft bores in the engine block. The gaging elements and classifying equipment were supplied by the Federal Products Corporation, Providence, R. I., while the handling, positioning, and control portion of the machine was made by Ingersoll. This gage not only checks the products of automatic machining, but checks the result of an automatic assembly operation as well.



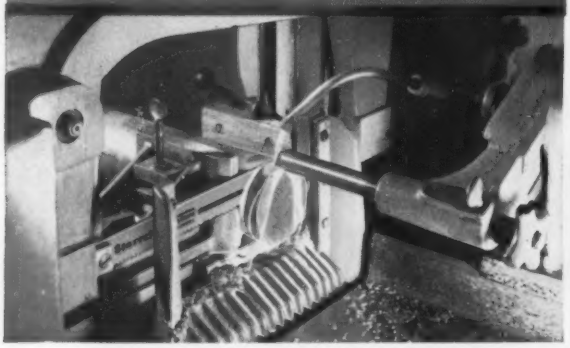
Combination automatic gage and transfer machine built by Ingersoll Milling Machine Co. and equipped with Federal gaging elements

Air-electric gaging equipment in the transfer line inspects the engine blocks and marks the acceptable ones to show their relative size. Blocks that are not acceptable are not allowed to continue to the next operation.

Twenty inside diameters—two each in five crankshaft bores and two each in five camshaft bores—are measured. In addition, the alignment of oil-holes in the five bearing liners is checked for automatic assembly alignment with the oil-holes in the camshaft bores. All of these conditions are

(Continued on page 226)

HACKSAWS



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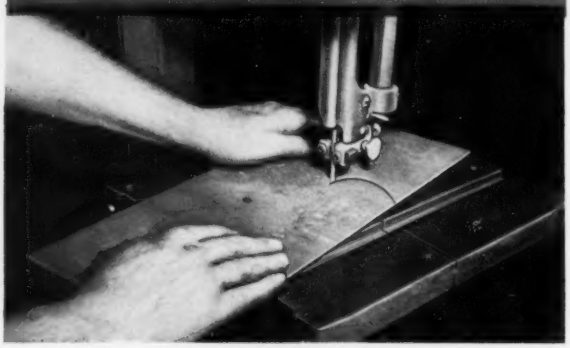
MEASURING TOOLS AND PRECISION INSTRUMENTS · PRECISION GROUND FLAT STOCK · STEEL TAPES · HACKSAWS · HOLE SAWS · BAND SAWS · BAND KNIVES

BAND SAWS



PRODUCTION-PROVED TO CUT FASTER, LAST LONGER

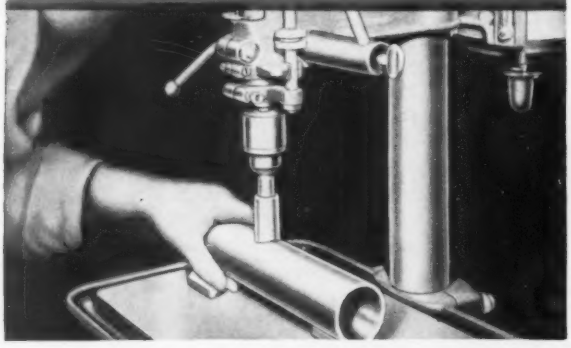
Starrett-engineered blade construction means uniform cutting action, less chance of blade breakage. Starrett makes regular, "skip-tooth," spring temper and friction cutting types for all metal cutting applications as well as regular and "skip-tooth" types for cutting wood, plastics, fibre and non-ferrous metals. Furnished in coils or cut to length and welded, ready for use.

Starrett

SINCE 1880 WORLD'S GREATEST TOOLMAKERS

MEASURING TOOLS AND PRECISION INSTRUMENTS · PRECISION GROUND FLAT STOCK · STEEL TAPES · HACKSAWS · HOLE SAWS · BAND SAWS · BAND KNIVES

HOLE SAWS



DOUBLE-WELDED AND SHATTERPROOF SIZES FROM 9/16" TO 6"

These new Starrett high speed welded edge hole saws are designed for long, hard, safe use without shattering. Use them to cut clean, round holes in metals, plastics, woods . . . any machinable material up to 1 1/8" thick. Interchangeable arbors hold a wide range of saw sizes. Four different arbors available to fit power tools, lathes, drill presses.

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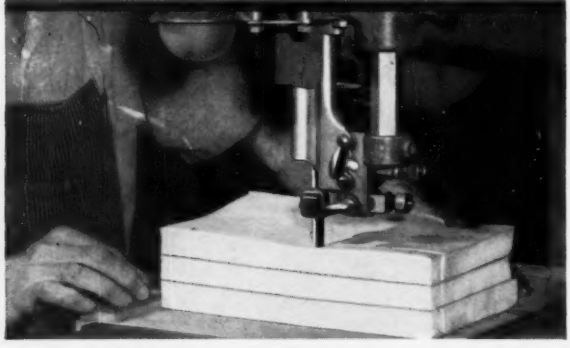
BAND KNIVES



FOR SOFT OR FIBROUS MATERIALS . . . 3 TYPES, ALL SIZES

Use Starrett FAST-KUT Band Knives for clean, fast, efficient cutting of all soft or fibrous materials. No chips, dust or waste. Ideal for stack cutting, trimming, slicing, cut-apart operations, etc. Available in a complete range of sizes in straight-edge, scallop-edge, or wavy-edge types — single or double bevel.

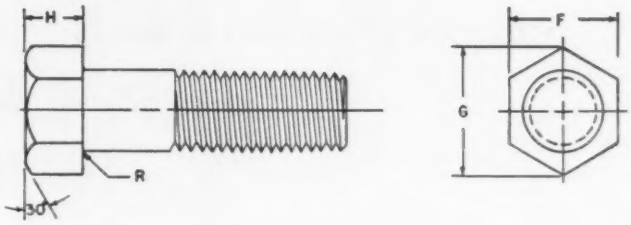
NEW SAW CATALOG

Describes the complete line of Starrett hacksaws, hole saws, band saws and band knives. Write for your free copy. Address Dept. D,

THE L. S. STARRETT COMPANY, ATHOL, MASSACHUSETTS, U. S. A.

For more information fill in page number on Inquiry Card, on page 241

AMERICAN STANDARD HEAVY HEXAGON BOLTS



Nominal Size or Basic Major Diameter of Thread	Body Diam.*	Width Across Flats F		Width Across Corners G		Height H			Radius of Fillet R
	Max.	Max. (Basic)	Min.	Max.	Min.	Nom.	Max.	Min.	Max.
1/2 0.5000	**0.515**	**7/8 0.8750**	**0.850**	**1.010**	**0.969**	**7/16**	**0.458**	**0.386**	**0.031**
5/8 0.6250	**0.642**	**1 1/16 1.0625**	**1.031**	**1.227**	**1.175**	**17/32**	**0.553**	**0.478**	**0.062**
3/4 0.7500	**0.768**	**1 1/4 1.2500**	**1.212**	**1.443**	**1.383**	**5/8**	**0.649**	**0.570**	**0.062**
7/8 0.8750	**0.895**	**1 7/16 1.4375**	**1.394**	**1.660**	**1.589**	**23/32**	**0.745**	**0.662**	**0.062**
1 1.0000	**1.022**	**1 5/8 1.6250**	**1.575**	**1.876**	**1.796**	**13/16**	**0.840**	**0.722**	**0.093**
1 1/8 1.1250	**1.149**	**1 13/16 1.8125**	**1.756**	**2.093**	**2.002**	**29/32**	**0.936**	**0.814**	**0.093**
1 1/4 1.2500	**1.277**	**2 2.0000**	**1.938**	**2.309**	**2.209**	**1**	**1.032**	**0.906**	**0.093**
1 3/8 1.3750	**1.404**	**2 3/16 2.1875**	**2.119**	**2.526**	**2.416**	**1 3/32**	**1.128**	**0.997**	**0.093**
1 1/2 1.5000	**1.531**	**2 3/8 2.3750**	**2.300**	**2.742**	**2.622**	**1 3/16**	**1.224**	**1.089**	**0.093**
1 5/8 1.6250	1.658	2 9/16 2.5625	2.481	2.959	2.828	1 9/32	1.319	1.181	0.125
1 3/4 1.7500	**1.785**	**2 3/4 2.7500**	**2.662**	**3.175**	**3.035**	**1 3/8**	**1.415**	**1.272**	**0.125**
1 7/8 1.8750	1.912	2 15/16 2.9375	2.844	3.392	3.242	1 15/32	1.511	1.364	0.125
2 2.0000	**2.039**	**3 1/8 3.1250**	**3.025**	**3.608**	**3.449**	**1 9/16**	**1.606**	**1.394**	**0.125**
2 1/4 2.2500	2.305	3 1/2 3.5000	3.388	4.041	3.862	1 3/4	1.798	1.577	0.188
2 1/2 2.5000	2.559	3 7/8 3.8750	3.750	4.474	4.275	1 15/16	1.990	1.760	0.188
2 3/4 2.7500	2.827	4 1/4 4.2500	4.112	4.907	4.688	2 1/8	2.181	1.944	0.188
3 3.0000	3.081	4 5/8 4.6250	4.475	5.340	5.102	2 5/16	2.373	2.128	0.188

*There may be a reasonable swell or fin under the head or die seam on the body not to exceed the nominal body diameter by the following: 0.030 inch for sizes up to 1/2 inch; 0.050 inch for sizes 5/8 and 3/4 inch; 0.063 inch for sizes over 3/4 inch up to 1 1/4 inches; 0.093 inch for sizes over 1 1/4 inches up to 2 inches; 0.125 inch for sizes over 2 inches up to 3 inches; and 0.188 inch for sizes over 3 inches.

All dimensions given in inches.

BOLD TYPE indicates products unified dimensionally with British and Canadian standards.

Bolt is not finished on any surface.

Taper of head (angle between one side and axis) shall not exceed 2 degrees, specified width across flats being the largest dimension.

Top of head shall be flat and chamfered. Diameter of top circle shall be maximum width across flats within a tolerance of minus 15 per cent.

Bearing surface shall be at right angles to axis of body within a tolerance of 3 degrees for 1-inch size or smaller, and 2 degrees for sizes larger than 1 inch. The bearing surface shall be concentric with axis of body within a tolerance of 3 per cent of maximum width across flats.

Minimum thread length (extreme point to last complete thread) shall be twice the diameter plus 1/4 inch for lengths up to and including 6 inches, and twice the diameter plus 1/2 inch for lengths over 6 inches. Bolts too short for the formula thread length shall be threaded as close to the head as practical.

Thread shall be coarse-thread series, Class 2A.

Tolerance on bolt length for bolts 6 inches and under in length shall be plus or minus 1/16 inch for 1/2 inch size; plus or minus 1/8 inch for sizes 5/8 inch to 1 1/4 inches; and plus or minus 1/4 inch for sizes 1 3/8 to 3 inches. Length tolerance for bolts over 6 inches in length shall be plus or minus 3/32 inch for 1/2 inch size; plus or minus 3/16 inch for sizes 5/8 inch to 1 1/4 inches; and plus or minus 1/4 inch for sizes 1 3/8 to 3 inches.

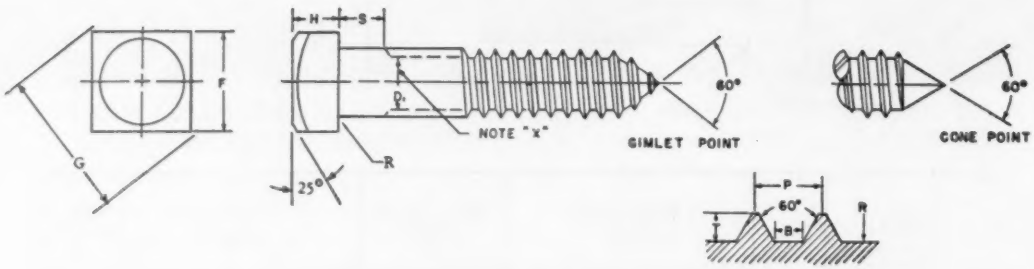
Bolts shall enter ring gage to head; ring gage shall have a maximum thickness of one diameter, a minimum fillet equal to the maximum fillet of the bolt, and an internal diameter equal to the specified maximum body diameter.

Suitable material for steel bolt is covered in Tentative Specification for Steel Machine Bolts and Nuts and Tap Bolts of the American Society for Testing Materials (ASTM A-307).

While not now considered standard, heavy square-head bolts were formerly made to head width and height of heavy hexagon-head bolts. Angle of bolt-head chamfer, 25 degrees.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

AMERICAN STANDARD LAG BOLTS



Diameter of Bolt		Threads per Inch	Thread Dimensions: Pitch P	Thread Dimensions: Flat at Root B	Thread Dimensions: Depth of Thread T	Thread Dimensions: Root Diam. R	Width Across Flats F: Max.	Width Across Flats F: (Basic)	Width Across Flats F: Min.	Width Across Corners G: Max.	Width Across Corners G: Min.	Height H: Nom.	Height H: Max.	Height H: Min.	Length of Shoulder for Rolled Thread S: Min.	Radius of Fillet R: Max.
No. 10	0.1900	11	0.091	0.039	0.035	0.120	9/32	0.281	0.271	0.398	0.372	1/8	0.140	0.110	0.094	0.031
1/4	0.2500	10	0.100	0.043	0.039	0.173	3/8	0.3750	0.362	0.530	0.498	11/64	0.188	0.156	0.094	0.031
5/16	0.3125	9	0.111	0.048	0.043	0.227	1/2	0.5000	0.484	0.707	0.665	13/64	0.220	0.186	0.125	0.031
3/8	0.3750	7	0.143	0.062	0.055	0.265	9/16	0.5625	0.544	0.795	0.747	1/4	0.268	0.232	0.125	0.031
7/16	0.4375	7	0.143	0.062	0.055	0.328	5/8	0.6250	0.603	0.884	0.828	19/64	0.316	0.278	0.156	0.031
1/2	0.5000	6	0.167	0.072	0.064	0.371	3/4	0.7500	0.725	1.061	0.995	21/64	0.348	0.308	0.156	0.031
5/8	0.6250	5	0.200	0.086	0.077	0.471	15/16	0.9375	0.906	1.326	1.244	27/64	0.444	0.400	0.312	0.062
3/4	0.7500	4 1/2	0.222	0.096	0.085	0.579	1 1/8	1.1250	1.088	1.591	1.494	1/2	0.524	0.476	0.375	0.062
7/8	0.8750	4	0.250	0.108	0.096	0.683	1 5/16	1.3125	1.269	1.856	1.742	19/32	0.620	0.568	0.375	0.062
1	1.0000	3 1/2	0.286	0.123	0.110	0.780	1 1/2	1.5000	1.450	2.121	1.991	21/31	0.684	0.628	0.625	0.093
1 1/8	1.1250	3 1/4	0.308	0.133	0.119	0.887	1 11/16	1.6875	1.631	2.386	2.239	3/4	0.780	0.720	0.625	0.093
1 1/4	1.2500	3 1/4	0.308	0.133	0.119	1.012	1 7/8	1.8750	1.812	2.652	2.489	27/32	0.876	0.812	0.625	0.093

All dimensions given in inches.

Thread formulas: Pitch $= \frac{1}{\text{Number of threads per inch}}$

Flat at root = pitch × 0.4305
Depth of single thread = pitch × 0.385

Note X—Threads shall be rolled or cut. Diameter of rolled-thread shank is not dimensioned, but is indicated by D_1. All rolled-thread lag bolts shall be provided with shoulder S.

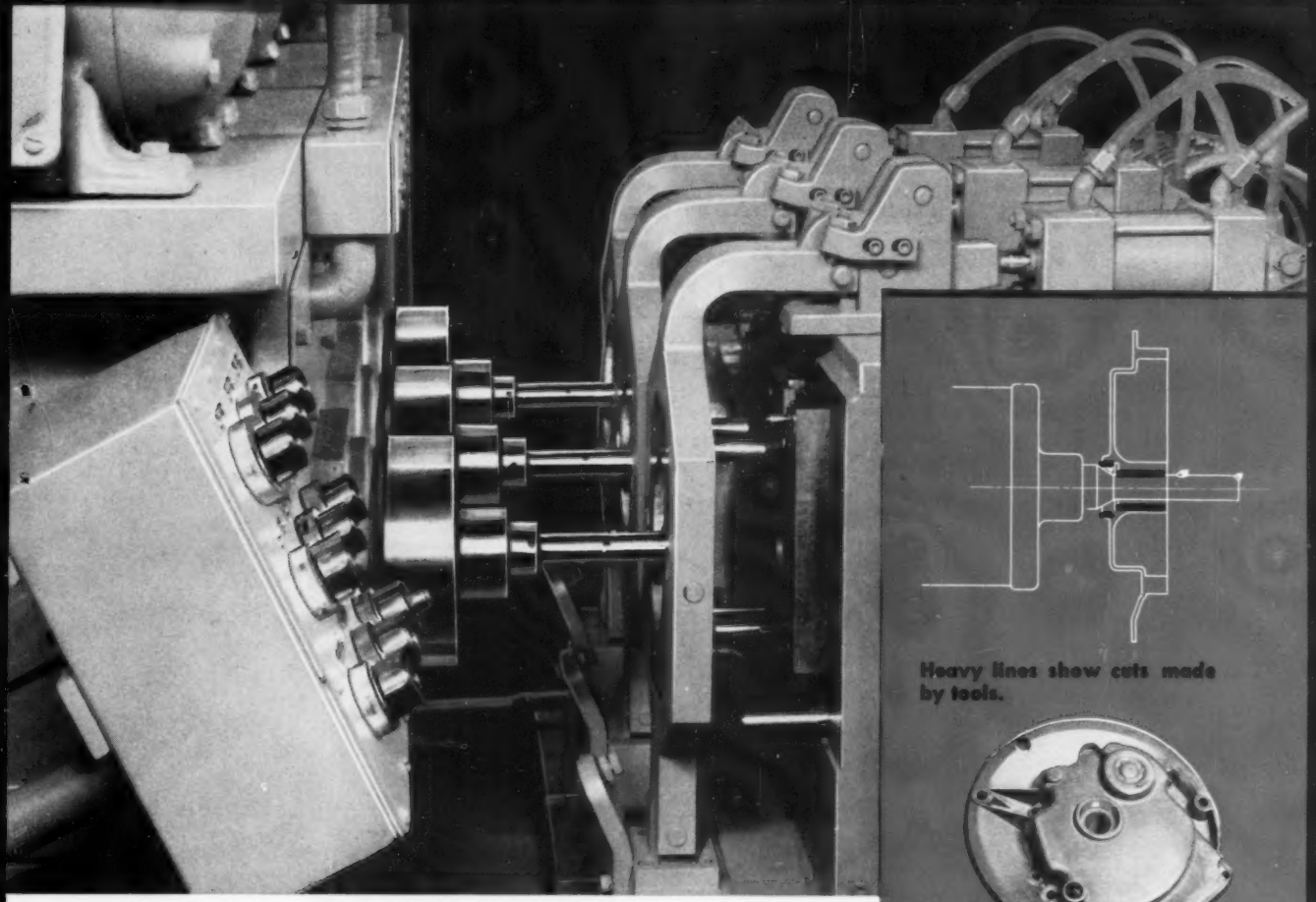
Minimum thread length equals 1/2 of the length plus 1/2 inch. Bolts too short for formula thread length shall be threaded as close to the head or shoulder as practical.

Tolerances for length of bolt shall be plus or minus 1/8 inch for bolts 1/2 inch by 6 inches and smaller, and plus or minus 1/4 inch for larger and longer bolts.

Suitable material for steel lag bolts is low-carbon steel; other materials will be as agreed upon by the manufacturer and user.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

inspected simultaneously. The and the alignment of the oil-holes **Chenienne Vertical Shaper**



Close-up view of the three-station work fixture. Note hydraulic clamping arrangement.

3 Parts Every 36 Seconds

A large manufacturer of appliance components slashed production costs with a standard Ex-Cell-O Boring Machine. The machine rough and finish bores and counterbores the central holes in aluminum mounting flanges at the rate of *3 parts every 36 seconds!* That's 5 parts per minute!

The machine that performs this operation is the Ex-Cell-O Style 112-D, a hydraulically-operated single-end boring machine. Rugged and versatile, this machine uses one or more spindles for rotation of either the part or tools for accurate boring of a wide variety of medium and large-size parts. With the right tooling, this standard machine can handle both large and small production runs, or can be adapted to a completely automated installation!

This type of machine can make a big difference in your production figures. To find out *how much* difference get a quotation from your Ex-Cell-O representative.

Heavy lines show cuts made by tools.

Aluminum mounting flanges automatically bored on this Ex-Cell-O Boring Machine.

Full view of standard Ex-Cell-O Style 112-D Precision Boring Machine, built for extra production.

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57-19

inspected simultaneously. The measuring is done with ten air plugs which are automatically inserted into the bores. Each of the plugs for the crankshaft bores takes two diameter measurements at opposite ends of the bores and at right angles. The plugs for the camshaft bores make similar diameter measurements.

Signal lights give a visual indication of the condition of the engine block. If all twenty diameters and the alignment of the oil-holes are within tolerance, a green light indicates that the part is good. A stamping unit then stamps a plus or minus sign on each end of the block to indicate whether the No. 1 crankshaft and the No. 5 crankshaft bores are above or below the nominal size within the tolerance limits. If any one dimension is outside limits, the block is shunted out of the line.

Circle Item 130 on postcard, page 241

Lapmaster Tooling Designed for Lapping Cylinder Heads

The Crane Packing Co., Morton Grove, Ill., has announced new Lapmaster tooling equipment designed especially for precision mechanical lapping of the flanged faces of radial aircraft-engine cylinder heads. Special combination lapping and conditioning rings replace the standard conditioning rings on the lap-plate of the machine.

When the machine is running, these rings are driven from a gear in the lap-plate drive-shaft, thereby creating a lapping action on the flanged face, since the cylinder is held in a fixed position by a simple holding fixture. At the same time, the regular lap-plate is engaged in truing the under side of the special rings.

The flat lapping surface, always available in this lapping procedure, is said to reduce lapping time by at least one-third. A balanced lapping procedure permits the lapping of two cylinder heads in the same cycle along with rocker box covers, thrust washers, and shaft seals held in a standard conditioning ring.

Circle Item 131 on postcard, page 241

Chomienne Vertical Shaper

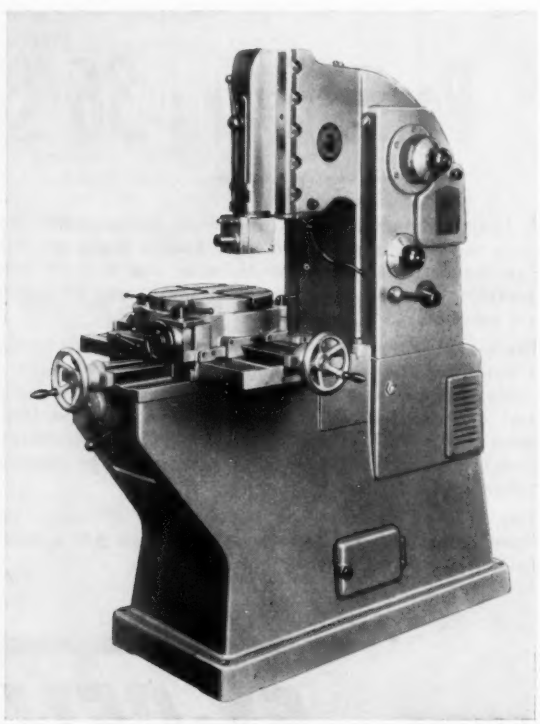
The Austin Industrial Corporation, White Plains, N. Y., is introducing in this country a Chomienne 5-inch vertical shaper designed for toolroom work and for short production runs of parts requiring machining of regular or irregular internal or external contours in a single setup. This machine, imported from France, has longitudinal and transverse carriage movements of 11 1/2 inches and a rotary movement through the built-in 12 1/2-inch rotary table. Lateral movements are obtained by handwheel-operated accurate lead-screws with worm and worm-gear movement of the rotary table.

Ram stroke is adjustable up to 5 inches. Accelerated ram speed on the return stroke is obtained by a rocker arm in the ram drive. The vertical shaper is driven through multiple V-belt drive from a 2-H.P. motor enclosed in the base. The motor also drives the oil pump which automatically lubricates all moving parts.

Circle Item 132 on postcard, page 241

(This section continued on page 228)

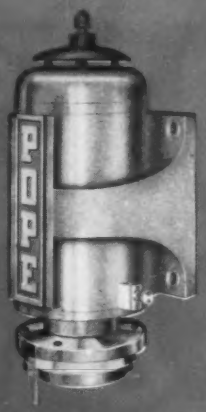
Lapmaster equipped with tooling designed for lapping aircraft-engine cylinder heads



Chomienne vertical shaper introduced in this country by the Austin Industrial Corporation

completely equipped for full auto-

How to lower your production cost with the right Spindle for your job and the right Spindle Service



POPE designs and builds precision anti-friction bearing spindles — belt driven, motorized or high frequency — for your standard or special machines for milling, boring, grinding, drilling, cutting and many other operations. *More than 20,000 different Spindles to choose from.*

POPE builds spindles to *your design.*

POPE builds *special* spindles for use in your own shop for grinders, boring machines, etc.

POPE provides standard *replacement* spindles for your present shop equipment.

POPE provides *repair* and *rebuilding* service for any make of spindle — belt driven, motorized or high cycle.

POPE provides *precision parts* for your spindles, such as shafts, flingers, locknuts, sleeves, spacers, etc.

POPE provides *interchangeable extension arbors* for your internal grinding spindles — *wheel holders* for any spindle — any size wheel. Just send us your specifications.

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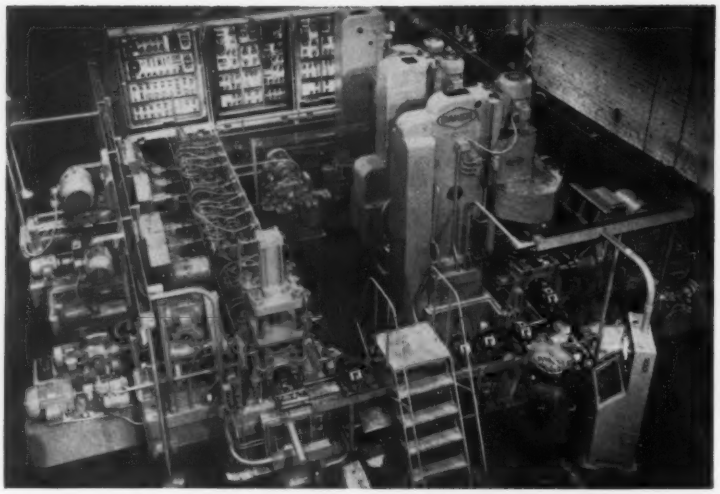


Fig. 1. Fully automatic transfer machine made up from standard automation components brought out by Baker Brothers, Inc.

Baker Automation Units Standardized to Simplify Assembly of Automatic Transfer Machines

A new line of standard automation components has been brought out by Baker Brothers, Inc., Toledo, Ohio, to simplify the assembling of special production line equipment such as the fully automatic transfer machine shown in Fig. 1. The basic Model 1215 hydraulic slide shown in Fig. 2 is one of several standard sizes in the new line of automation units available for incorporation in production machines like the one illustrated in Fig. 1. Twin-pull, hydraulic-feed cylinders, saddle, ways, limit switches, and switch cams are included with units such as shown in Fig. 2.

The standardization of as many components as possible is being accomplished to reduce the engineering and manufacturing costs of automation. A complete line of standard components is now available for Baker hydraulic machines that perform drilling, boring, facing, chamfering, tapping, and other operations. These standard components consist of a series of hydraulic slides, drive boxes, and power sources for hydraulic feed. These are already being incorporated in Baker machines—from single units up to many of the most complex transfer machines.

To the standard units have been added those components which must necessarily be specials—such as certain heads and tooling. The final assembled machines, though basically standard, are even being completely equipped for full automation with loading and unloading devices and conveyors.

Circle Item 133 on postcard, page 241

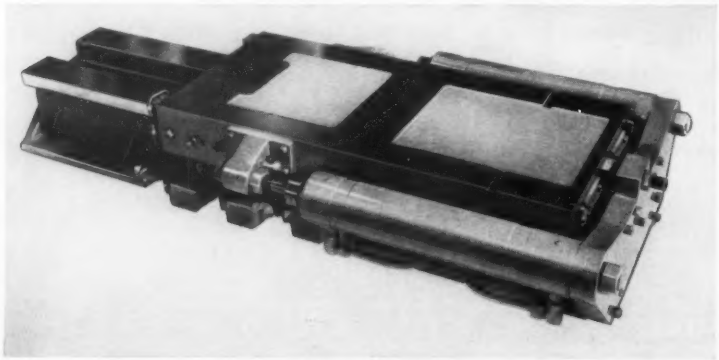
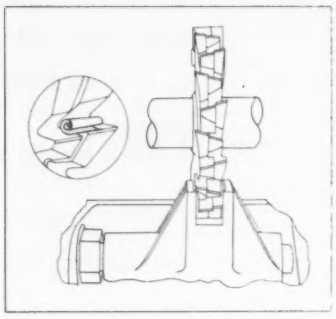


Fig. 2. Basic standardized hydraulic slide developed by Baker Brothers, Inc.

Interlocking Cutters for Deep Slotting Operations in Steel

The Barber-Colman Co., Rockford, Ill., is manufacturing an improved line of interlocking, staggered-tooth, side-milling cutters with a patented tooth arrangement which has the trailing edge of the leading section always slightly ahead of the leading edge of the following section. This feature is said to eliminate any obstruction to the free flow of chips.



Staggered-tooth side-milling cutter. Circular inset shows chip formation

Absence of chip accumulation also reduces the cutting temperatures and serves to eliminate tooth breakage. It is claimed that this feature permits the use of high feeds and speeds which would stall conventional cutters. Cuts to a depth limited only by the cutter hub can be taken without impairing cutting efficiency. The interlocking feature permits the use of shims to keep the cutter at its normal cutting width. By varying the thickness of the shims, it is also possible to use the same cutter for slots of several widths.

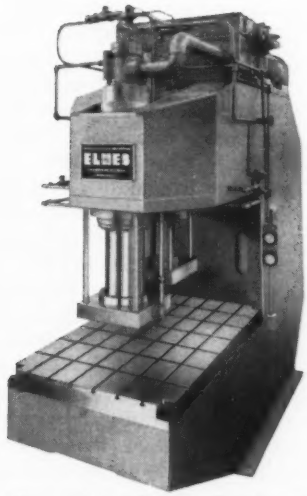
The new cutters are recommended for long, deep slotting cuts in steel, shoulder cuts, and for milling operations where the depth of cut exceeds the width of the cutting face. They work equally well in steel or soft, non-ferrous materials.

Circle Item 134 on postcard, page 241

(This section continued on page 230)

No pressing problem TOO TOUGH for an Elmes

"Job-Fitted" HYDRAULIC PRESS



Elmes 600-ton C-Frame Forming and Straightening Press. This press has two 300-ton cylinder assemblies. Either assembly can be operated individually, or both can be operated in unison for a total capacity of 600 tons. An excellent example of the adaptation of a standard Elmes design to meet special requirements.

"Missionary work" needn't get you in a stew. When development planning presents really tough problems in pressure application—*that's* the time to call Elmes "to the rescue," for consultation and recommendations. More than 60 years of specialized hydraulic press experience makes Elmes preeminently equipped to provide *the right press for the job.*

It may be that a standard-design Elmes® Press—for drawing and forming, bending, forcing, straightening, hobbing, etc.—will meet all your requirements. Or a simple adaptation may be indicated. Or unusual production requirements may call for development of a special "custom built" press—a large and important part of Elmes service to industry.

In any event, whatever your particular needs, Elmes experience and ingenuity are your best bet for turning pressing problems into profit-making performance. Distributors in principal industrial centers.

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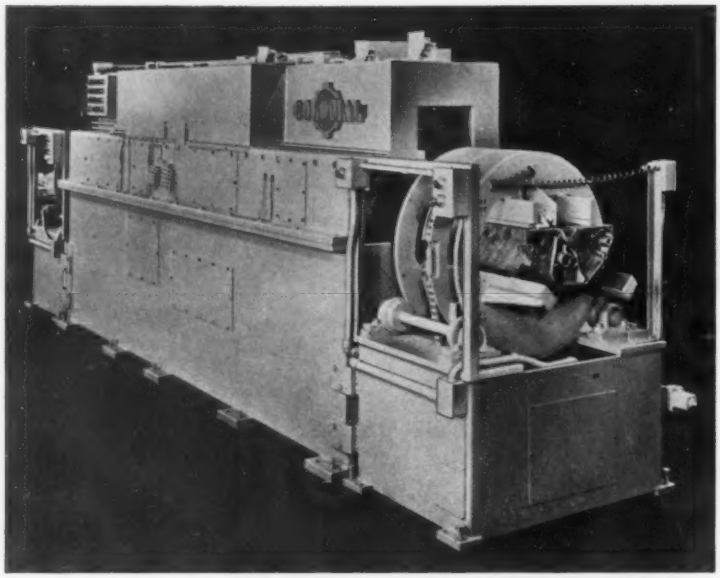


Fig. 1. Horizontal tunnel type broaching machine developed by Colonial Broach & Machine Co. for processing cylinder blocks

Tunnel Type Broaching Machine for Processing Engine Cylinder Blocks

A tunnel type broaching machine for automated-line processing of engine cylinder blocks has been developed by the Colonial Broach & Machine Co., Detroit, Mich. Parts are automatically fed to this horizontal broaching machine through a turnover positioning unit for one-pass overhead broaching by a hydraulic traveling ram. Transfer units progressively move the parts into an elevating station where the broaching operation takes place.

In one application for broaching ten bearing surfaces of a cast-iron V-8 cylinder block an automatic cycle time of 29.5 seconds was obtained with the 6-ton, 54-inch stroke model of the tunnel type machine, using a cutting speed of 30 feet per minute. For this operation, six parts are automatically kept in a work sequence —one in an entry turnaround unit, four in the machine proper, and one in the exit turnaround unit. Line conveyors feed and remove the engine blocks. Transfer bars progressively move the inverted parts through the machine. At the broaching station, a hydraulic elevator raises the part into the broaching position with alignment accurate to 0.0005 inch. The overhead broaching operation removes a maximum of 0.025 inch of stock in one pass, leaving a high-quality surface finish. The broaching cycle is started by limit switches actuated by dogs on the work-positioning bar. Completion of the stroke actuates another limit switch for advancing the work. All limit switches are interlocked to insure safe operation.

Circle Item 135 on postcard, page 241

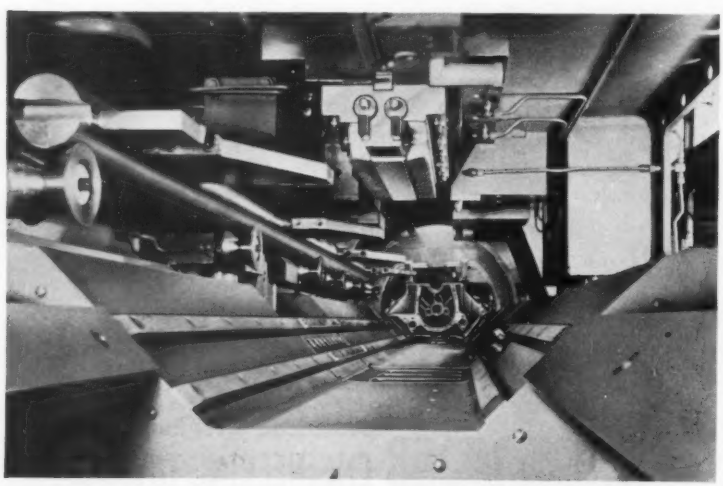


Fig. 2. Internal view of Colonial horizontal broaching machine shows overhead position of tools

Michigan Gear Speeder for Noise Checking of Large Gears

Easier and truer noise inspection of large-size mating gears is said to be possible with a modified standard gear speeder announced by the Michigan Tool Co., Detroit, Mich. This Model 1129-SP gear speeder uses enclosed spindles and a special built-in listening horn for better definition of noise characteristics. The machine can be provided with fittings for contact microphones and other acoustical equipment.

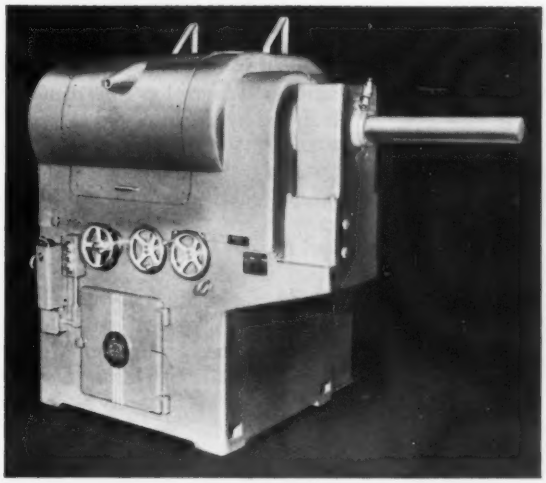
In operation, only one spindle is driven while brake loads are applied to the opposite spindle. The driven spindle is reversible. Control of the gear speeder is simplified by the use of push-buttons and manually-operated handles. Four spindle speeds (580, 870, 1160, and 1740 R.P.M.) are obtained from a four-speed constant-torque 3/4-H.P. motor. The motor has a sealed sleeve bearing and is dynamically balanced. The external contact friction brakes are manually operated and accommodate a variable load.

The speeder will accept gears up to a maximum diameter of 23 inches with a maximum face width of 10 inches. The center distance range is 2 1/2 to 12 inches,

which, together with the variable-

before the drills are fed through

Twenty-One-Column



Gear speeder for checking noise of large gears announced by Michigan Tool Co.

Air gaging instrument announced by the Air Gage Division, Dearborn Gage Co.

and the distance between centers on both front and rear spindles is 25 inches. Floor space requirements are 46 1/2 by 99 inches. Standard fixtures are provided for gears to be tested.

Circle Item 136 on postcard, page 241

Dearbornaire Multiple-Column Air Gage

A new standard line of multiple-column air gaging instruments which rapidly check a number of close-tolerance surfaces at the same time is announced by the Air Gage Division, Dearborn Gage Co., Dearborn, Mich. The multiple-column arrangement of this equipment is designed to permit the accurate and simultaneous measurement of up to eight separate dimensions, with gage response within five-tenths of a second.

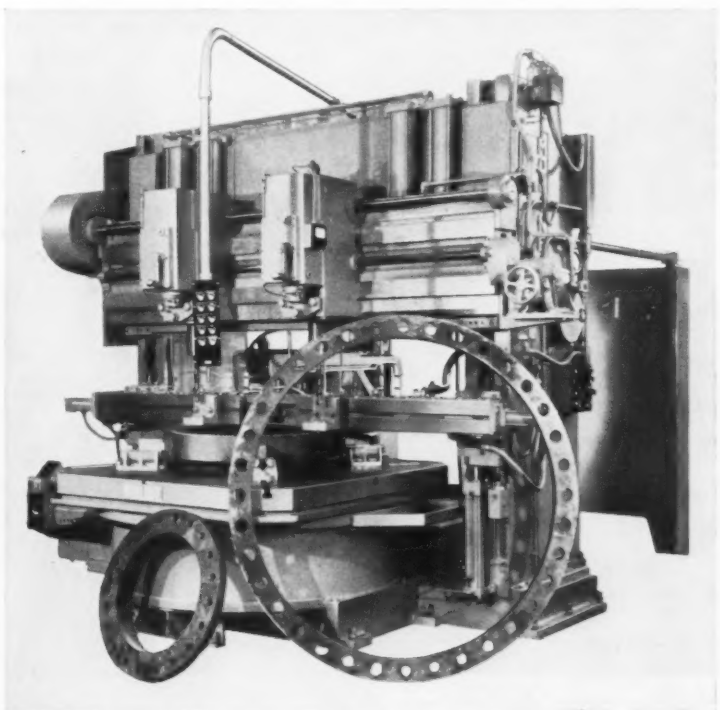
Any number of columns required for a given application can be provided for this gage—in cases where purchasers wish to fabricate their own gaging fixtures rather than to have them included with the order, stock delivery is available in standard instruments ranging from two-column to eight-column multiples.

Major features of this new Dearbornaire line include a new, self-cleaning pressure system, complete linearity over the full scale, interchangeable component parts, two-step amplification conversion, and zero-centered scale permitting tolerances to be read as plus or minus from the nominal dimensions.

Circle Item 137 on postcard, page 241

Special Bolt Circle Drilling Machine

The Moline Tool Co., Moline, Ill., has brought out a No. HD6S special drilling machine for drilling bolt holes on layout circles from 12 to 100 inches in diameter. Each of the two spindle heads of this machine has the capacity for drilling a hole 2 1/2 inches in diameter in steel. Each spindle also has quick, two-speed adjustment



Moline special bolt circle drilling machine

which, together with the variable-speed direct-current spindle drive motor, permits a total speed range ratio of 9 to 1. An indicating tachometer shows spindle speed in revolutions per minute. Hydraulic power moves the rail carrying the spindles at rapid traverse and feed rates on vertical ways. A motor-driven screw with handwheel serves to adjust the center distance between spindles.

The hydraulic-powered, rotating table provides automatic indexing for thirty different hole spacings on a bolt circle. Drill guide bushings are used for spotting holes to full diameter, after which the drills are withdrawn from the bushings, and the bushings are moved out of the way before the drills are fed through the work. The hydraulic feed rate is adjustable and also can be set for a steady rate of advance or for step-drilling. All of these functions are combined in one cycle.

When a work-piece is to be loaded or unloaded from clamping vises on table, the drill bushing support can be raised up out of the way by electric push-button-controlled hydraulic power. After the work is clamped in place and the bushing support is returned to working position, the "cycle start" button is used to initiate a complete automatic operating sequence which ends when the predetermined number of holes in a bolt circle has been drilled.

Circle Item 138 on postcard, page 241

Traveling Head Straightening Press

Williams-White & Co., Moline, Ill., has brought out a traveling head straightening press having a capacity of 75 tons. This machine has a table 124 by 60 inches and a gantry travel of 100 inches. The daylight over-the-table capacity is 26 inches, and the stroke, 14 inches. The ram advances at a speed of 42 inches per minute, applies full pressure at a speed of 5 1/2 inches per minute, and returns at the rapid rate of 78 inches per minute.

Gantry and underneath crossbeam are connected by two shouldered steel columns. Four wheels with anti-friction bearings support the gantry on its bed. Travel of the gantry along the bed is by means of a handwheel. Control of the ram is by a hand lever mounted on the gantry.

Circle Item 139 on postcard, page 241

Twenty-One-Column Precisionaire Gage

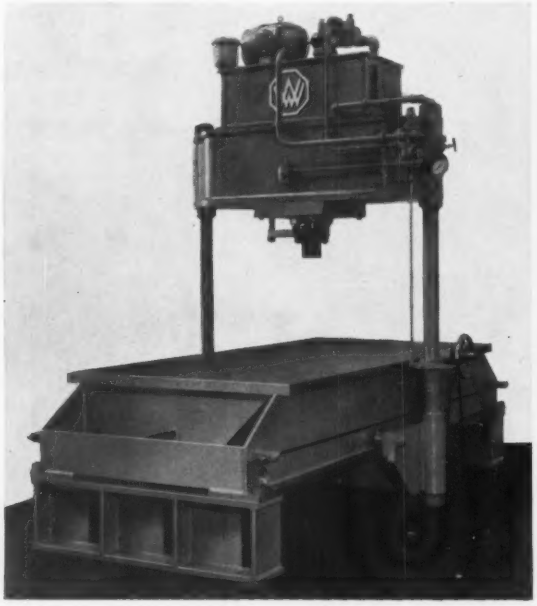
Four twenty-one-column Precisionaire gages have been manufactured by the Sheffield Corporation, Dayton, Ohio, for checking hard-to-reach dimensions and conditions on aluminum transmission cases at the rate of between fifty and fifty-five cases per hour. This multi-dimension air gage checks the diameters of six bores and two lengths. It makes three parallelism and four combination squareness and concentricity tests. Also, it performs five flatness tests and measures one pan-face-to-dowel location dimension.

The operator places the part on a stationary gaging spindle having five different size gaging diameters along its length, locks the part in position with quick-action hand clamps, and inserts a hand type air gage spindle into the top of the part. Next, he rotates the part 360 degrees about the spindle to check the concentricity of the diameters with center line. Flatness of the pan face is gaged at five places.

Float positions in the Precisionaire gage show whether each dimension or condition is within the required tolerance.

Circle Item 140 on postcard, page 241

(This section continued on page 234)



Straightening press with traveling head brought out by Williams-White & Co.

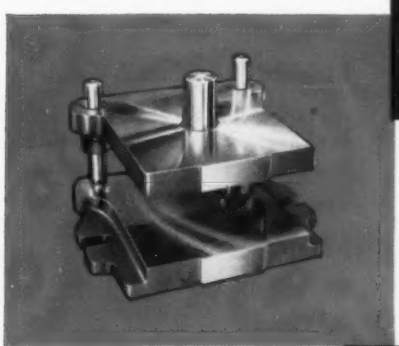
One of four Precisionaire gages manufactured by the Sheffield Corporation

NOW!

All Four Horizontal Surfaces Ground

ON NEW DANLY DIE SETS

To a large extent Danly leadership in die set design can be attributed to its constant search for better methods and means to improve die sets and their operation. Typical of this is the fact that Danly Die Set punch holders and die holders are ground on both sides. By grinding all four horizontal surfaces, Danly assures a true and level alignment when punch and holder are set in the press. Isn't this another important reason why you should specify die sets from Danly?



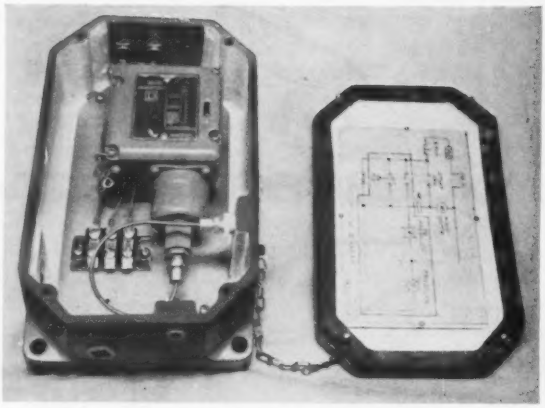
Leading industrial distributors and Danly branch assembly plants—located in all major tooling centers—stock Danly Die Sets for fast delivery.

DANLY MACHINE SPECIALTIES, INC.

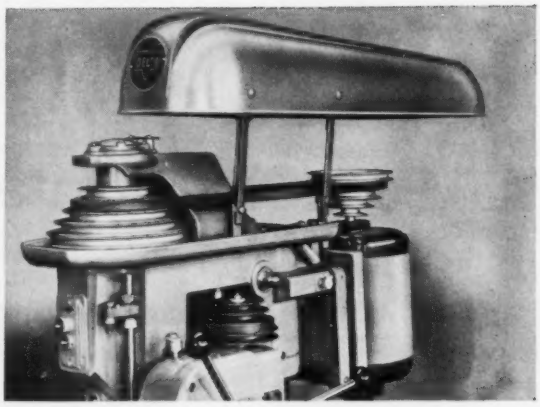
DANLY®

2100 South Laramie Avenue
Chicago 50, Illinois

For more information fill in page number on Inquiry Card, on page 241



"Cyclesafe" unit that protects machines from damage because of lubrication failure



Rockwell drill press equipped with new molded fiber glass belt guard

"Cyclesafe" Unit Protects Against Lubrication Failure

A package unit, called "Cyclesafe," that provides full protection against automatic lubrication failure is being manufactured by the Seneca Falls Machine Co., Seneca Falls, N. Y. This unit automatically stops the machine when the lubrication pressure drops below a predetermined setting. It allows the machine to complete the working cycle, however, before stopping, thereby eliminating tool, cutter, die, or knife damage or breakage. The machine cannot be restarted until the cause of the failure has been corrected and oil pressure is restored. The unit contains standard electrical connections (conforming to J.I.C. and NMTBA standards) and can be easily mounted on a machine.

Circle Item 141 on postcard, page 241

Oil- and Air-Hardening Flat Ground Die Steel

The Heller Tool Co., Newcomerstown, Ohio, has introduced a complete line of more than 1300 standard stock sizes of flat ground die steel for a wide variety of tool and die applications. The Heller "Nucut" die steel features a surface finish of 25 to 35 micro-inches, easy machinability, and wide hardening ranges. Surfaces, ready for immediate layout, are protected in shipment and storage by special packaging which includes complete heat-treating directions.

The oil-hardening type is a high-grade molybdenum alloy tool steel. It is spheroidize annealed for easy machinability. Wide hardening range permits heat-treatment with the simplest of equipment. Rockwell C hardness of 64-65 may be achieved by hardening in the range of 1450 to 1540 degrees F. Heller oil-hardening flat ground

Heller oil- and air-hardening flat ground steel

die steel may be used for a wide variety of toolroom products.

The air-hardening type is a 5 per cent chrome alloy which provides for a high degree of wear resistance, as well as a wide hardening range. Tools made from this steel are particularly suited to punching silicon or stainless steels, Monel, and other abrasive metals, or for long production runs where the tool must be kept in service without frequent sharpening. Hardness of Rockwell C 63-65 is achieved within a temperature range of 1700 to 1800 degrees F.

The oil-hardening type is available in 18- and 36-inch lengths, in widths up to 14 inches.

Circle Item 142 on postcard, page 241

Fiber Glass Guard for Drill Press

The Rockwell Mfg. Co., Pittsburgh, Pa., is using molded fiber glass, instead of the conventional steel stamping, for the belt guard of its new 20-inch drill press. Use of this material has reduced shipping costs because the fiber glass guard is approximately 50 per cent lighter than a sheet metal guard of the same design. The new guard deadens the sound of motor and belt operation—a significant advantage where several of the machines are used in a confined production area. Also, it is said to be stronger than the steel guard.

Circle Item 143 on postcard, page 241

Lincoln "Idealarc" Welders

The Lincoln Electric Co., Cleveland, Ohio, has added two welders to its line of "Idealarc" combina-

Lincoln 250-ampere "Idealarc" welder

Why the Die Maker Prefers PRODUCTO Die Sets

Volkert Stampings, Inc.

The die maker likes to work with Producto Die Sets

He knows Producto die sets are easy to assemble —especially those equipped with the unique new Qwik-Fit Guide Pins*.

He has confidence in the consistent accuracy of Producto sets. He has found that they always align his dies correctly.

He knows he can choose from a variety of thicknesses the Producto die set that meets the strength requirements of his die.

He favors Producto die sets because they are dependable. They will perform on the press as well as they did in tryout.

He likes the attractive, streamlined appearance of Producto sets. They make his dies look better and increase his pride in these products of his craftsmanship.

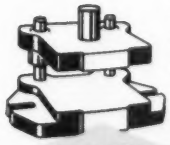
*Patent Pending

He knows that a nearby Producto warehouse can supply any catalog die set he needs...and that orders for specials are promptly processed. He can count on having the die set by the time he needs it.

The die maker has found that all of his requirements are met by Producto die sets. You will, too, when you place your order with Producto.

DIE SET DIGEST, our eight-page quarterly, contains valuable data for designers, makers and users of dies. Write to have your name added to mailing list.

PRODUCTO MACHINE COMPANY
Housatonic Ave., Bridgeport 1, Connecticut



PRODUCTO

Wherever die sets are used

PRODUCTO

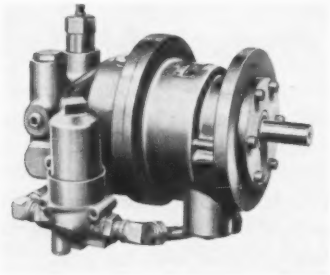
PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

tion alternating- and direct-current welders. The new machines have capacities of 180 and 250 amperes. They are designed to operate equally well either as an alternating-current transformer type welder or a direct-current rectifier type welder. The "two-in-one" feature permits the use of all types of manual electrodes, including stainless steel and alloy rods.

The machines operate on single-phase, 230-volt, alternating-current input power as contrasted with three-phase power required for most direct-current welders. Power factor correction condensers and special input voltages are available as optional features.

Continuous current control is provided for the entire range of welding heat which extends from current suitable for light sheet metal to current required for heavier plate and structural steels. A direct-reading indicator shows the current setting. The welders are NEMA-rated, 180 amperes at 25 volts, 20 per cent duty cycle for the 180-ampere model and 250 amperes at 30 volts, 30 per cent duty cycle for the 250-ampere model.

Circle Item 144 on postcard, page 241



Oilgear constant displacement heavy-duty pump with filter

Oilgear Heavy-Duty Pump with Filter

A constant displacement pump, designed for heavy-duty, continuous operation at pressures of from 3000 to 5000 pounds per square inch, requiring 3 to 10 H.P., has been announced by the Oilgear Co., Milwaukee, Wis. Capacities at operating pressures of 3000 pounds per square inch range from 1 to 5 gallons per minute, depending on the size and speed of the driving motor. This pump unit is suited for use on die-casting machines; large injection molding presses; double-acting or four-way differential presses; calender hold-downs; or similar equipment.

A complete range of mountings are available for the new pump which has been fully field and laboratory life-tested. Oilgear's patented, one-piece, alloy-steel, axial rolling pistons and balanced flat (port) valves have been incorporated in this new pump to insure long, trouble-free life.

Circle Item 145 on postcard, page 241

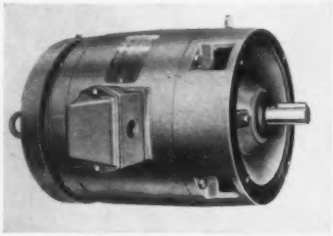


Fig. 1. Totally protected, vertical solid shaft motor announced by the Reliance Electric & Engineering Co.

Reliance Motors

A complete line of totally protected, solid shaft P-base motors designed for vertical pump installations is being manufactured by the Reliance Electric & Engineering Co., Cleveland, Ohio. These vertical motors, with normal thrust bearings in all sizes from 1 to 40 H.P. and high thrust bearings in sizes from 1 to 15 H.P., are available in protected, totally enclosed, or explosion-proof enclosure types as shown in Fig. 1. They have "Metermatic" lubrication which automatically regulates the flow of lubricant to the bearings.

Also available is a line of Reliance totally enclosed, alternating-current motors (see Fig. 2) in which the horsepower output varies according to the varying velocities of an air stream. This effect is accomplished by the cooling action of the air flowing over the motor frame from the fan or blower driven by the motor. With this arrangement the output can be increased without exceeding the rated temperature rise of the motor. These motors are available in the new NEMA frame sizes from 1/2 through 30 H.P. and may be operated on 208-volt systems.

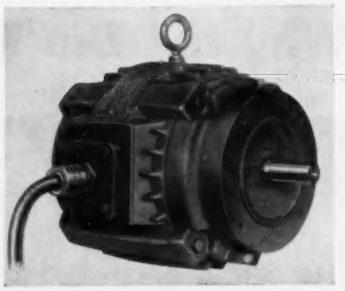


Fig. 2. Reliance motor that varies its power output as velocity of cooling air changes

Circle Item 146 on postcard, page 241

Welding Positioner

The Positioning Equipment Division of the Worthington Corporation, Harrison, N. J., has announced Model 10P welding positioner for automatic welding requiring close speed regulation. It has a load capacity of 1000 pounds. The table is 29 inches in diameter and has four T-slots.

The positioner is designed for extremely accurate handling of lightweight weldments for all manual and automatic welding operations. It is operated by a 1/3-H.P. electronic, variable-speed drive which includes dynamic braking and jogging and has a speed regulation of 2 per cent of set speed.

The positioner has a manual- or motor-operated height adjustment of from 27 to 42 inches.

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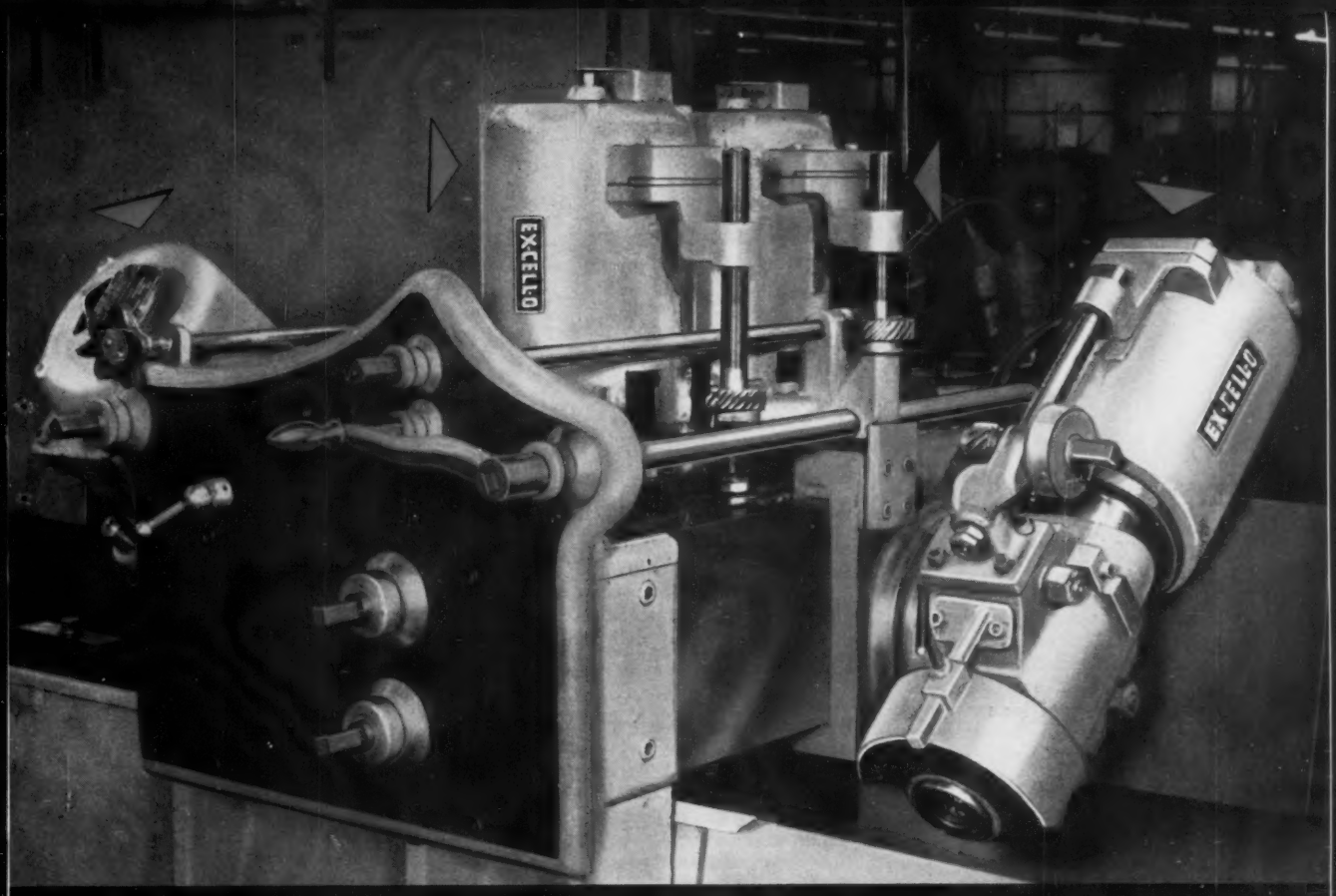
Worthington welding positioner



This Idea Multiplied Production by Two...

EX-CELL-O SPINDLES— AN INGENIOUS APPLICATION

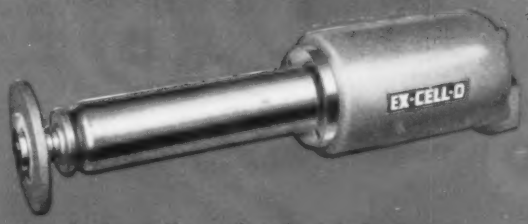
A machinery builder in Kalamazoo, Michigan was faced with the problem of finish grinding both flat and angular dovetail ways on the column, knee and table of his vertical milling machines. Surface lengths varied from 9" to 24"; tolerances on flat and parallel measure had to be within .001" in 24". Workpieces were gray iron sand castings.

Conventional way to do the job—an oscillating surface grinder to work each dovetail separately. Production men thought they could improve on convention. They built up their own machine from an old planer bed, added a bridge to support four Ex-Cell-O Precision Spindles and retained the standard planer feed.

The result: grinding both sides of four dovetail surfaces in one-pass planer fashion for a saving of roughly 50 percent in per unit cost. Perhaps you too have an operation which could be performed more economically by an Ex-Cell-O Spindle; or perhaps you simply want to use the most versatile, dependable and long-lived spindle money can buy. In either case, you'll want to get in touch with your nearby Ex-Cell-O Representative, or contact Ex-Cell-O direct.

57-23

Above, four standard Ex-Cell-O Precision Grinding Spindles are utilized to grind four surfaces of machine ways in one pass.



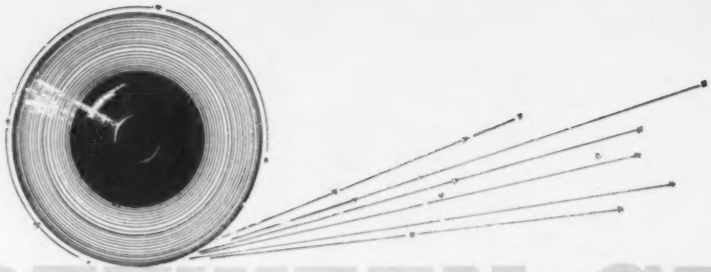
Standard, totally enclosed motorized surface grinder spindle is rated one horsepower at 3600 rpm. Also available in a range of higher horsepower.

XLO EX-CELL-O FOR PRECISION

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT



By E. S. Salichs

BETWEEN GRINDS

Man in Swing Now Out on Limb

Have you noticed that the little man in the hammock slung between grinding machines has gone from the top of this page? He spent a number of leisurely years with us; personally, we miss him, but the sentiment here was to retire him.

A Wrench for the Wench

Caption under cartoon which pictures a woman customer in a hardware store speaking to a clerk behind the counter: "I don't know what it's called, but it's to tighten loose things and loosen tight things."

Warm Invitation from Furnace Manufacturer

"Be our guest" is the invitation on the No. 12 leaflet sent out by Ipsen Industries, Inc., Rockford, Ill. "Visit our plant and laboratory at your convenience. You will fly in one of the latest and fastest of planes—our new five-passenger Aero Commander." Deflighted, we mean, delighted to accept.

By-passed by Diana, the Huntress

In a newspaper article giving advice to single business girls aspiring to matrimony, the suggestion was made for them to obtain positions in a field where they would be in touch with the public —but not engineering firms because "most engineers either marry their hometown sweethearts or girls they met or meet in school." One less occupational hazard, sorry to say?

"Carrect"

Although we anticipate difficulty occasionally with the spelling of such names as Kosciusko, it would never occur to us that the name of the Spanish explorer De Soto could stump the people. But according to the automobile manufacturer which adopted the name twenty-nine years ago, the press and the public have managed to vary it. So a release was issued—please spell it De Soto (space between and cap S) "for Hernando's sake."

Edison Exasperated

Celebrating Thomas Alva Edison's birthday on February 11 (the hard-working inventive genius was born 110 years ago) called for some reminiscences on the part of Richard G. Berger, who joined Edison's laboratory staff, nicknamed "Insomnia Squad," in 1916. Said Mr. Berger, "Edison would lecture in his direct way on the evils of clock-watching, and would become angry at employes who quit on time. Some of the married men claimed that the long hours in the laboratory destroyed their home life." But did the lab clock actually send out electrical shocks?

AD CHIEF'S POWWOW—Ross Beirne (center), Giddings & Lewis advertising manager, holds confab over company's 1957 advertising campaign with John M. Dolan (right), vice-president and general manager, field sales division, and Emil Schap, account executive, Klau-Van Pietersom-Dunlap, Inc. Featuring 16-page, trade magazine advertising inserts—a new one each quarter—customer success stories tell "how it's done" with equipment made by G & L's four manufacturing divisions. Case histories in each insert describe dollar savings and increased efficiency obtained by firms in a particular geographical area, giving dealers there tie-in support.

"Fantastic" you say, Mr. Herb?

MACHINERY
AUGUST 1956

Gears for This Age of Cybernetics

nuclear energy will someday necessitate that gears must meet a tolerance which would restrict the total composite error to about 0.00003 inch. Sounds fantastic!

IN the past, when most gears were of relatively coarse pitch and were used solely for the transmittal of rotary motion, the problems of designers and production men were comparatively simple. Generally speaking, all the designer had to do was to specify gears of correct ratios and of adequate strength for the intended application. The production man simply had to make the gears accurate within reasonably close tolerances.

Today, the picture is greatly different. There is a demand for fine-pitch gears of unbelievable accuracy suitable for use in the ultra-precise control equipment of rockets, missiles, radar, and various other new developments in the field of aviation. Such gears must not only transmit force but must accurately measure angular position. They must also operate without backlash at high temperatures with no lubrication and under conditions of high vibration and shock loads. Some of these requirements must also be met by gears used in digital and analogue computing machines. They are the "brains" of mechanical-electrical control devices.

Gears in these categories are being regularly made to the Class 3 precision tolerance of the American Gear Manufacturers Association which calls for a total composite error of not more than 0.00025 inch and a total tooth-to-tooth composite error of only 0.0002 inch. Some engineers believe that demands for instruments in the fields of aviation and

Yet, [illegible] that described the [illegible] ments on which the tooth spacing must be true within 5 seconds of arc, the teeth having a circular pitch of only 0.050 inch—teeth with an addendum of only 0.0159 inch. How accurate the tooth spacing must be can be visualized when it is remembered that one second of arc amounts to a rise of only about 1/4 inch in a length of one mile. Even though the pitch diameter of the gear segments is over 6 inches, the permissible error in tooth spacing is less than 0.0001 inch.

This number of MACHINERY features an article that describes the manufacture of fine-pitch gears of various types to meet stringent instrumentation requirements. Another article dealing with the application of autocollimators to determine minute errors in fine-pitch gears has been scheduled for early publication.

Truly, the production of gears for our age of cybernetics, in which control systems are tending more and more to simulate the human brain and nervous system, has necessitated a manufacturing skill that would have been inconceivable to gearmakers of bygone days.

Charles O. Herb

EDITOR

the gear tester to check such accuracy is already here—

S & F Gear Tester.. guaranteed to repeat within .00002"

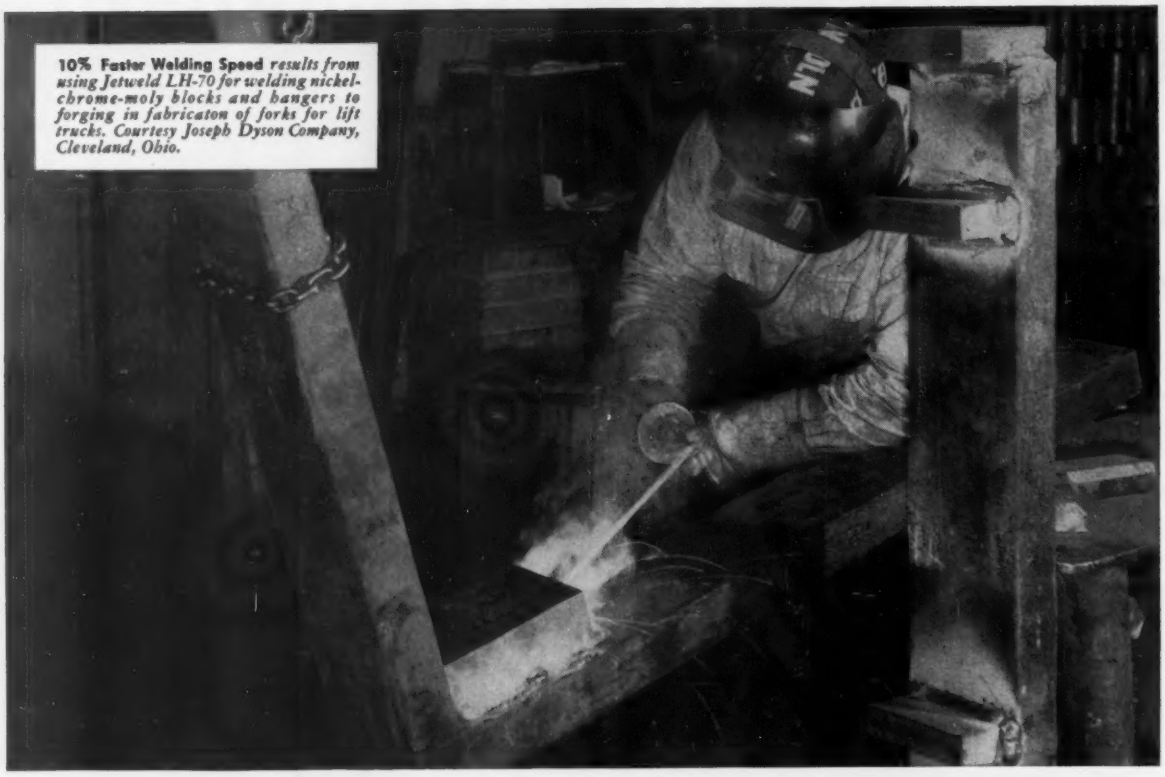
Checks all types and kinds of gears and assemblies

Ask for a demonstration or the name of the S & F user near you.

KO CO. INC INDUSTRIAL IMPORTERS

KURT ORBAN COMPANY, INC.

42 Exchange Place, Jersey City 2, N. J. • In Canada: 2490 Eglinton Ave. W, Toronto



10% Faster Welding Speed *results from using Jetweld LH-70 for welding nickel-chrome-moly blocks and hangers to forging in fabricaton of forks for lift trucks. Courtesy Joseph Dyson Company, Cleveland, Ohio.*

DEPENDABLE FOR HIGH-SPEED WELDING OF CRACK-SENSITIVE STEELS

Jetweld LH-70 by Lincoln
low-hydrogen, iron-powder, E-6016 electrode

Dependable Welding for
Crack-sensitive steels • Alloy steels without preheating
Medium to high carbon steels • Free machining steels

Higher Deposition Rate
Than conventional low-hydrogen electrodes

Easy Operation
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Meets X-ray requirements

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PRODUCT INFORMATION SERVICE

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On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

STEELS—Crucible Steel Company of America, Pittsburgh, Pa. 232-page product and warehouse catalogue—designed for purchasing agents and steel users—describing over 700 products available from stock and warehouses located throughout the country. The book index lists sixteen categories of special-purpose steels, including high-speed, tool, stainless, alloy, and machinery in 16,000 grades and sizes. More than twenty conversion and weight tables, as well as other information, are included. A copy of the catalogue may be obtained by sending a request on company letterhead to Engineering Service Department, Crucible Steel Company of America, Box 1558, Pittsburgh 30, Pa.

HONING DATA—Barnes Drill Co., Rockford, Ill. 44-page catalogue No. 550, describing how honing generates diametrically round and straight bores, automatically controlling size within "tenths" and producing a pre-selected degree of finish. Tables and charts are included for proper speed selection to obtain desired finishes in various materials. Included are instructions on how to calculate the work stroke for maximum honing efficiency. Requirements for various applications of honing are described, and difficult bores or surfaces are analyzed for production finishing by honing. This catalogue may be obtained by writing to Barnes Drill Co., Rockford, Ill.

METALWORKING DATA—E. W. Bliss Co., Canton, Ohio. 50-page illustrated booklet entitled "Computations for Metal Working in Presses," containing information and alignment diagrams for computing presses and sustained work capacity of presses, as well as pressure and work requirements. It provides information, formulas, and charts on blanking and shearing; drawing and reducing; ironing; coining, sizing, and forging; and extrusion. Another section contains information on selecting the proper press for the work to be done and discusses factors to be considered. There are also tables on properties of metals, sheet metal, and wire gages, and approximate diameters of blanks for shells. 1

OFFSET ROLLS—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 75C Supplement, describing the company's offset rolls and gage that reduce industrial pipe and elbow edging in a single operation. Bulletin graphically illustrates new method of forming offset flange on one edge of each segment. The plain edge of connecting piece slides into flange, and joint is ready for secondary fastening. Included also is an explanation of other factors that make offset rolls on Niagara rotary machines ideal for installing industrial blower, exhaust, and conveyance systems. 2

LATHE CONTOUR ATTACHMENTS—Warner & Swasey Co., Cleveland, Ohio. 8-page illustrated bulletin describing design features and specifications of the company's two contour attachments for turret lathes. These two attachments—one a cross-slide mounted turning and facing unit for the 2A, 3A, 4A and No. 5 turret lathes; the other a hex turret mounted boring unit for 3A and 4A machines—both utilizing the company's micro-sensitive control system. Details of this control system, as well as other operating features, are fully illustrated and described. 3

STAINLESS-STEEL DATA — Carpenter Steel Co., Reading, Pa. Pocket-size slide chart on machining stainless steels, containing information on how to machine the popular grades. On one side is given concise data on turning, drilling, tapping, threading, milling, and reaming operations. Feeds and speeds are tabulated, and special notes on drilling, tapping, lubrication, and welding are included. The other side of the chart shows relative workability of stainless steels in a wide variety of operations. An inserted slide moves to show, at a glance, the machining data desired. 4

THREADING MACHINE—Landis Machine Co., Waynesboro, Pa. Bulletin H-74, describing the company's 5C Landmaco threading machine—a single-spindle machine designed for the precision threading of small-diameter workpieces. Having a range of No. 4 to 5/8 inch, it will produce threads to Class 3 and 4 tolerances on a production basis and can be furnished with or without lead-screw feed. The bulletin also contains information on machine construction, specifications, and applications. 5

DESCALING EQUIPMENT—Commercial Shearing & Stamping Co., Youngstown, Ohio. Illustrated catalogue D 57 C, describing the company's hydraulic descaling equipment. Featured is the company's line of "Hydra-Jet" equipment for removal of scale from bars, slugs, and rolled-mill products prior to hot-working. Portable equipment and automatically controlled equipment for rolling mills, shell, crankshaft, axle, and other continuous production lines are also covered. 6

SCREW AND RIVET HEADERS—Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. Both 3/16- and 5/16-inch "Hi-Pro" solid-die, double-stroke crank headers for cold-heading screw and rivet blanks are extensively covered in

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this illustrated brochure. Information is given under special attachments for the knockout relief device and a gate knockout which provides positive second punch ejection of short shanked small blanks. **7**

PERMANENT MAGNETS—General Electric Magnetic Materials Section, Edmore, Mich. 12-page catalogue covering both cast and sintered permanent magnets. Included are data on magnetic and mechanical properties, approximate tolerances, magnet assemblies, sales and service, as well as how-to-order information on both cast Alnico 5 and sintered Alnico 2 permanent magnets. Illustrations and engineering data provide the user with information for various shapes available. **8**

PRECISION LATHE—Monarch Machine Tool Co., Sidney, Ohio. Catalogue 504, describing the company's Series EE, Model 1000 precision lathe featuring variable spindle speeds up to 2000 R.P.M., built-in constant surface cutting speed control, and electrical speed changing by means of a single selector knob. Complete information is supplied on a large array of optional equipment, including a cutting speed preselector which provides up to five automatic speed changes during operations. **9**

REGULATORS — Rockwell Mfg. Co., Pittsburgh, Pa. Bulletin No. 1044, containing revised size, capacity, and weight tables of Rockwell 120 sensitive regulators. The maximum inlet pressure of this line—designed for large appliances, industrial furnaces, gas engines, and similar gas-consuming appliances—has been increased from 5 to 10 psi by replacing the leather seal diaphragm with one made of special synthetic material. . . **10**

POWER UNITS—Detroit Diesel Engine Division, General Motors Corporation, Detroit, Mich. Catalogue outlining the company's entire line of power units for all types of industrial applications. Specifications are given on thirty-one engine models ranging from 44 to 761 brake horsepower, including the company's new six-cylinder Turbopower engine. **11**

METAL HEAT-TREATING—Pittsburgh Commercial Heat Treating Co., Pittsburgh, Pa. 32-page catalogue entitled "Specialized Equipment and Skills Devoted Exclusively to the Heat Treatment and Processing of Metals," presenting a pictorial story of the company's equipment and facilities. A glossary of heat-treating terms and a series of engineering tables are included. **12**

STAINLESS TUBING AND PIPE—Carpenter Steel Co., Alloy Tube Division, Union, N. J. 4-page bulletin on the company's 17-7PH* stainless tubing and pipe giving full description of the alloy in tubular forms along with analysis, recommended uses, typical mechanical properties, corrosion resistance, workability, and hardening characteristics. **13**

CUT-OFF MACHINE—DoAll Co., Des Plaines, Ill. Illustrated brochure describing the company's C-12 power saw, which is suited to applications where hard, tough, and expensive steels must be machined accurately and with a minimum of waste. A chart is included showing cutting rates and tool costs for machining of most carbon and alloy steels. **14**

MAGNETIC DRIVES—Whitney Chain Co., Hartford, Conn. Brochure describing the company's Whitney Tormag magnetic drives, including data on design, drive features, operating and performance curves, and output torque rating dimensions. Selection chart, as well as photographs of installations and applications, are included. **15**

SUBLAND CUTTING TOOLS—Detroit Reamer & Tool Co., Birmingham, Mich. Bulletin entitled "Subland Cutting Tools," providing in condensed and concise form descriptive material covering some of the more popular types of multi-purpose cutting tools. Also included are illustrations and descriptions of several types of subland cutting tools. **16**

AUTOMATIC SCREW MACHINE—Brown & Sharpe Mfg. Co., Providence, R. I. 12-page illustrated catalogue giving specifications, operation data, and features of the company's No. 2 automatic screw machine which is available in three different capacities to take stock to 3/4-, 1 1/4-, or 1 1/2-inch diameter. **17**

V-BELT DRIVES—Allis-Chalmers Texrope Drive Department, Milwaukee, Wis. Illustrated catalogue describing various types of V-belts and giving information on how to select and match them. Seven steps for the correct installation of belts are listed, and hints for making them last longer are included. **18**

TANDEM GEAR HOBBER—Michigan Tool Co., Detroit, Mich. Bulletin TH-33, describing the company's Model 1433 tandem gear hobber. Detailed design construction and operation of this "new concept" machine, and its easy adaptability to any degree of automation by means of a common sub-base, are fully covered. **19**

ALUMINUM EXTRUSION PRESS—Watson-Stillman Press Division, Farrell-Birmingham Co., Inc., Roselle, N. J. Bulletin 340-C, describing the company's aluminum extrusion presses and giving detailed description of design features and the services offered by the company to the extrusion industry. **20**

FILTERS—Industrial Filtration Co., Lebanon, Ind. 8-page brochure describing six major Delpark filter types for industrial applications. Filters offered include disposable media gravity type, combination gravity and magnetic, straight magnetic, vacuum, pressure, and screen type settling filters. **21**

AUTOMATIC SPRAY MACHINES—DeVilbiss Co., Toledo, Ohio. Illustrated catalogue covering the basic types of the company's automatic transverse spray finishing machines. Transverse machines of four types are covered—horizontal straight line, horizontal contour, vertical straight line, and vertical contour. . . **22**

MOTOR-GENERATOR SETS—Westinghouse Electric Corporation, Pittsburgh, Pa. Bulletin entitled "Motor-Generator Sets and Accessories for Induction Heat-

Product Information Service

Use postage-free Business Reply Card below for further information on New Catalogues or New Shop Equipment described in this issue and products mentioned in the advertisements.

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M-5/57

ing," containing many illustrations and describing the construction, operation, and application of the high-frequency motor-generator sets. 23

MILL PRODUCTS—Reynolds Metals Co., Louisville, Ky. 18-page catalogue entitled "1957 Reynolds Aluminum Mill Products," giving information on fabricating and finishing aluminum products, the company's styling and engineering services, and a selected list of helpful company literature and films. 24

HYDRAULIC PRESS LUBRICATION DATA—Lake Erie Machinery Corporation, Buffalo, N. Y. Bulletin 155, entitled "Hydraulic Oil Data and Lubrication Guide," giving information relating to hydraulic presses. Contents deal with supervision of hydraulic systems, preventive maintenance, oil specifications, and guide lubrication. 25

HARD-FACING WIRES—Stoody Co., Whittier, Calif. Folder describing hard-facing wires for semi-automatic application. Data on welding characteristics, suggested uses of the eleven wires listed, and general information on the semi-automatic process are included. 26

SHEET-METAL WORK MACHINES—Niagara Machine & Tool Works, Buffalo, N. Y. 20-page booklet No. 202, summarizing important data on the company's power-operated machines for light sheet-metal work. This catalogue provides quick reference to all principal models. 27

STEEL FORGINGS—American Brake Shoe Co., New York City. 16-page catalogue containing information on the application of steel forgings. Well illustrated, this catalogue also depicts research, engineering, and production facilities for drop, press, and upset forgings. 28

DUAL-CHANNEL FLAW CALIBRATOR—Industrial and Scientific Products Division of Curtiss-Wright Corporation, Caldwell, N. J. Leaflet describing the company's Model 429 dual-channel flaw calibrator that automatically monitors sizes of defects in materials. 29

SPRING-LOADED THERMOCOUPLE—Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. Bulletin S001-6, describing spring-loaded thermocouples for applications such as plastic extrusion machines or engine bearings where the measured surface may tend to move away from the T/C due to heat or cold. . . .30

TUNGSTEN CARBIDE—Kennametal, Inc., Latrobe, Pa. Leaflet describing characteristics of the company's Grade K501 tungsten carbide with platinum binder for severe corrosion conditions. Typical uses, workability, and physical and chemical properties are given. . .31

OPTICAL HEIGHT GAGE—Webber Gage Co., Cleveland, Ohio. 6-page folder describing the company's micro-accurate gage which combines two principles of measurement—Webber gage blocks and the Leitz measuring microscope—creating an entirely new concept of accuracy. 32

CONTOUR-SAWING MACHINE—Do-ALL Co., Des Plaines, Ill. Folder describing the principle of guiding the tool instead of the work on the company's Model 5 contour-sawing machine. Specifications and design features are described and illustrated. 33

PRECISION CARBIDE TOOLS—Heller Tool Co., a subsidiary of Simonds Saw & Steel Co., Newcomerstown, Ohio. Catalogue CT-2, describing the company's precision carbide tools. Illustrated are: end-mills, drills, reamers, burrs, countersinks, and special cutting tools. 34

PUMPS—Barnes Mfg. Co., Mansfield, Ohio. Catalogue containing data on pumps. A selector chart which aids industrial, commercial, and other users of fluid-handling equipment in choosing the model best suited to their needs is included. 35

CONTROL VALVES — Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. Bulletins S 810-11 and S 810-12, giving details of construction on single-seated and double-seated Honeywell Series 800 diaphragm control valves. . .36

PRESSROOM EQUIPMENT—Sesco, Inc., Detroit, Mich. 16-page catalogue featuring the company's patented hydraulic system with detailed drawing and description. Information on equipment for the handling of coil stock is given. 37

GAGES—Ellstrom, Inc., Dearborn, Mich. 4-page illustrated folder listing prices, specifications, and suggested applications for the company's "Shalo-Chek" adjustable indicator gage. The three standard models are described. 38

SUBLAND DRILLS—Mohawk Tools, Inc., Montpelier, Ohio. Illustrated booklet enumerating the steps in manufacturing of both the subland drill and the step drill and presenting the maintenance requirements of both. 39

METALLIZING POWDER—Wall Colmonoy Corporation, Detroit, Mich. Illus-

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trated engineering data sheet discussing the use of the company's C-250* metallizing powder for producing superior crankshaft bearing surfaces. 40

CONDENSERS—Acme Industries, Inc., Jackson, Mich. 8-page catalogue describing the company's line of FLOW-MIZER evaporative condensers which are offered in ten different models, with a capacity range to 200 tons. 41

HORIZONTAL INDEXING MACHINE—Hartford Special Machinery Co., Hartford, Conn. Illustrated bulletin describing the company's 65-inch horizontal indexing machine built from standard machine components. 42

DEEP CLAMP—Cincinnati Tool Co., Cincinnati, Ohio. Folder describing the company's No. 48 deep clamp with forged steel heat-treated frame and large diameter full-length screw with forged wing. 43

GRINDERS—McGonegal Mfg. Co., East Rutherford, N. J. Illustrated catalogue describing the company's Themac high-speed precision toolpost grinders with circumferential, adjustable grinding spindles. 44

CONTOUR GRINDER—Industrial Tool Engineering Co., Detroit, Mich. Folder describing the company's tracer-controlled, completely flexible, hydraulic contour grinder. 45

COMPARATORS—Pratt & Whitney Co., Inc., West Hartford, Conn. Illustrated catalogue describing the company's Electrolimit comparators for gaging inside and outside dimensions. 46

RESISTORS—General Electric Co.'s Industrial Control Department, Roanoke, Va. 36-page bulletin describing the company's complete line of vitreous enameled stock resistors—both fixed and slide wire. 47

RESISTANCE-WELDING MACHINES—Taylor-Winfield Corporation, Warren, Ohio. Bulletin 10-813-A, describing the company's tri-phase resistance-welding machines. 48

INJECTION MOLDING MACHINES—Lester-Phoenix, Inc., Cleveland, Ohio. Brochure describing in detail features of the company's injection molding machines. 49

FASTENERS—Huck Mfg. Co., Detroit, Mich. Catalogue No. 8-350, describing the company's SAL and SLS featherweight Huckbolt fasteners for aircraft application. 50

POSITIONERS—Aronson Machine Co., Arcade, N. Y. 8-page bulletin No. SU57, featuring a variety of small welding positioners from 75 to 500 pounds capacity. 51

HACKSAWS—Henry Disston Division, H. K. Porter Co., Inc., Philadelphia, Pa. 8-page folder describing the company's complete line of hacksaw blades and frames. 52

POSITIONING TABLE—Jones & Lamson Machine Co., Springfield, Vt. Illustrated folder describing the company's numerically controlled positioning table. ...53

AIR COMPRESSORS—Bell & Gossett Co., Morton Grove, Ill. Bulletin giving details on the company's line of oil-less air compressors and vacuum pumps. 54

TESTING MACHINE—Tinius Olsen Testing Machine Co., Willow Grove, Pa. Leaflet describing the company's Air-O-Stress-Rupture and Creep testing machine. 55

GEAR HONING—National Broach & Machine Co., Detroit, Mich. 4-page bulletin describing the company's Red Ring gear-honing process. 56

DISINTEGRATION MACHINE — Cammann Mfg. Co., Cleveland, Ohio. Leaflets C56 and C66, describing the company's metal disintegrators. 57

LATHES—Sidney Machine Tool Co., Sidney, Ohio. Bulletins 1256-1, 1256-2, and 1256-3, describing and illustrating the company's various Models 32 Dial-Master lathes. 58

STAGING FIXTURE — Optical Gaging Products, Inc., Rochester, N. Y. 8-page catalogue describing the company's "O.G.P. Multi-Use Stage" staging fixture. 59

DIRECT-CURRENT MOTORS—Induction Motors Corporation, Westbury, L. I., N. Y. Data sheet giving engineering information on the company's 2000 series DC motors. 60

MILLING MACHINES—Crowningshield, Inc., Greenfield, Mass. Catalogue describing and illustrating the company's line of milling machines. 61

PRECISION SURFACE GRINDER—Harig Mfg. Corporation, Chicago, Ill. Folder describing the company's completely re-engineered TML precision surface grinder. 62

LATHES—South Bend Lathe Works, South Bend, Ind. Illustrated folder describing the company's 13-inch lathes and accessories. 63

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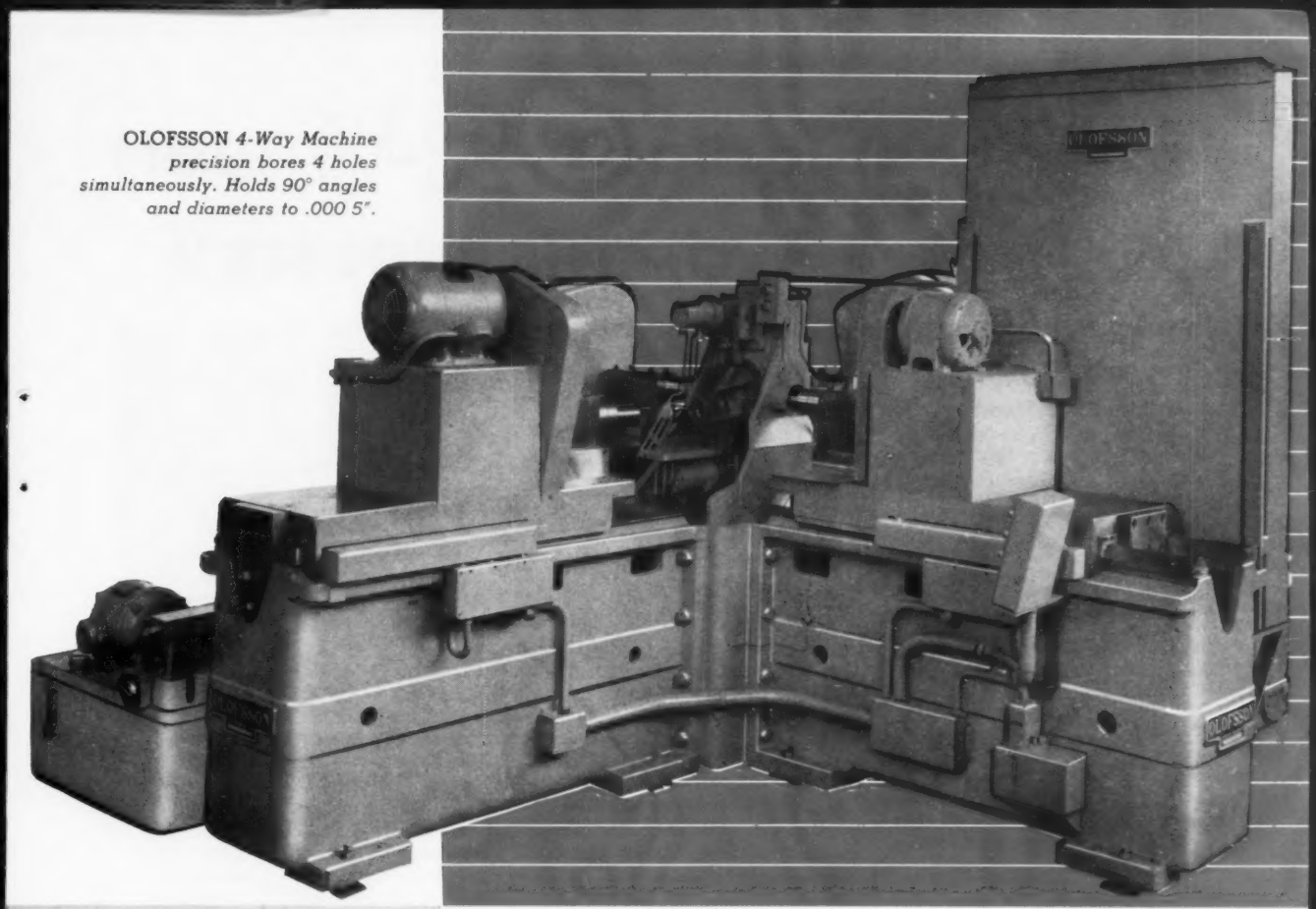
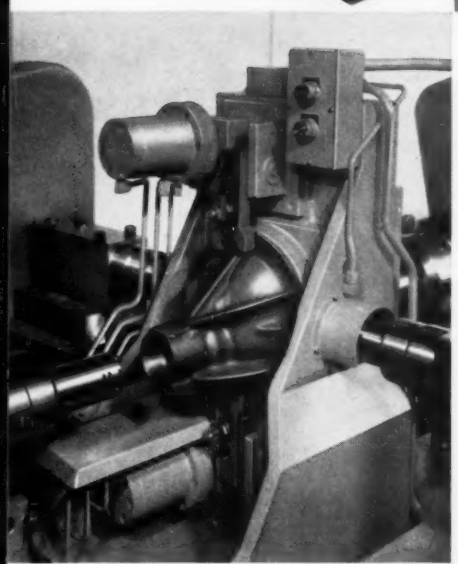
OLOFSSON *4-Way Machine precision bores 4 holes simultaneously. Holds 90° angles and diameters to .000 5".*





Close-up view of differential carrier, hydraulically cam-clamped in position for boring.

for MORE production and precision, combine 2, 3, or 4 OLOFSSON way units in any COMBINATION

OLOFSSON Precision Way Machines perform fast, accurate boring, facing, turning, grooving, and chamfering. Units are electrically interlocked, and the spindles move to the work.

For long, dependable, and accurate operation Olofsson Way Units feature:

- **Single push-button control panel.**
- **Hardened and ground V-style ways.**
- **Hydraulic control Valves, manifold mounted and located with reservoir.**
- **Parker Majestic precision boring spindle.**
- **Rigid ribbed, nickle iron base.**
- **Adherence to latest J.I.C. recommendations.**
- **Hydraulic pump units located outside base.**
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News OF THE INDUSTRY

California

GIDDINGS & LEWIS MACHINE TOOL Co., Fond du Lac, Wis., has named DAYTON & BAKEWELL, Los Angeles, Calif., exclusive Southern California distributor for its G & L and Hypro Division.

HUGHES AIRCRAFT CO., Culver City, Calif., announces two promotions in its manufacturing division: GEORGE H. MCKAIG is the newly appointed manager of production planning. JAMES T. JONES has been named manager of production engineering.

WILLIAM E. CROWLEY, Pittsburgh sales representative for the Garlock Packing Co., Palmyra, N. Y., has been named district manager for the company's San Francisco branch.

Illinois and Wisconsin

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announces the following executive appointments: HARDIE W. BECK has been appointed to the newly created post of sales manager for the company's steel service plant in Pittsburgh. ROBERT H. WASZ was named general manager of the San Francisco steel service plant. He succeeds WAYNE D. DUKETT, whose appointment as general manager at Los Angeles was previously announced. ROBERT L. LARSON has been appointed general manager for the company's Indianapolis, Ind., plant now under construction.

CHICAGO-LATROBE TWIST DRILL WORKS, Chicago, Ill., announce the following appointments: R. D. MYERS, sales and service engineer, has been transferred to Portland to represent the company in the Pacific Northwest territory covering Oregon, Washington, Idaho, Montana, and Wyoming. R. E. THORNBERRY, formerly of Detroit, has joined the staff as service engineer.

ANDREW B. PULLIAM has been appointed vice-president and general manager of Borg-Warner Corporation's Marvel-Schebler Products Division, Decatur, Ill. Mr. Pulliam came to the Chicago central offices in 1956 as a director of manufacturing services.

WILLIAM F. ROSS has been named marketing manager of Ipsen Industries, Inc., Rockford, Ill., and also of Ipsenlab of Rockford, Inc., and Ipsenlab of Canada, Ltd. Mr. Ross was formerly manager of the Industrial Furnace Division of A. F. Holden Co., Detroit, Mich.

DR. HUBERT J. PESSL has been appointed director of research and education for Verson Allsteel Press Co., Chicago, Ill. During the past two years, Dr. Pessl has served as consultant for the company's research and development center.

VASCOLOY-RAMET CORPORATION, Waukegan, Ill., announces opening of a branch office at 1514 N. Pennsylvania Ave., Indianapolis, Ind.

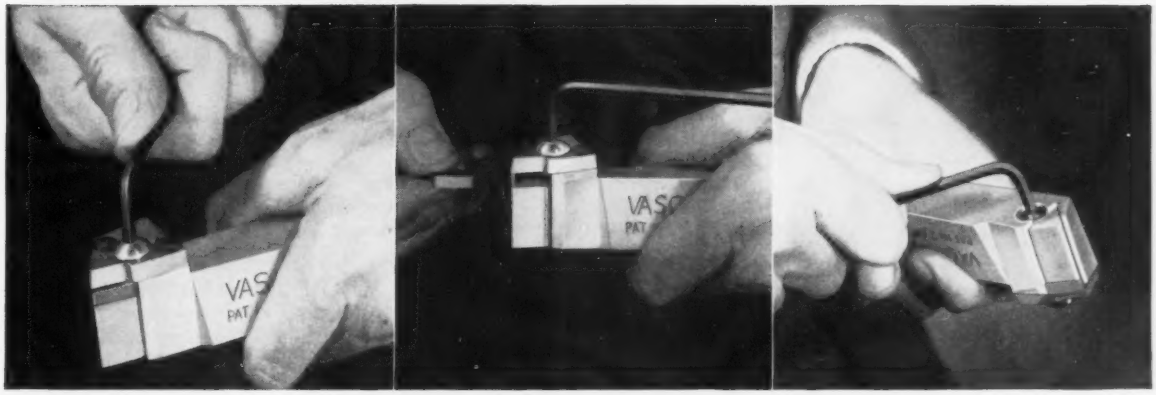
ILLINOIS TOOL WORKS, Chicago, Ill., announce the sale of their Power Saw Blade Division to the E. H. WACHS CO., also of Chicago.

CRANE PACKING CO., Morton Grove, Ill., announces four executive promotions: CARL E. SCHMITZ to executive vice-president from his former capacity as vice-president in charge of sales. VANCE E. VORHEES to vice-president in charge of sales from assistant general sales manager. B. H. STENBERG to vice-president in charge of manufacturing from works manager. E. H. STUBENRAUCH to assistant general sales manager from divisional sales manager. The company has just completed an extensive expansion program throughout the United States and Canada, which included a new factory, laboratory

(Continued on page 248)

(Left to right) Hardie W. Beck, sales manager, Pittsburgh; Robert H. Wasz, general manager, San Francisco; and Robert L. Larson, general manager, Indianapolis, of Joseph T. Ryerson & Son, Inc.

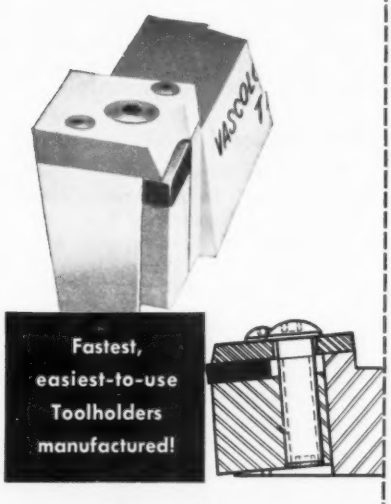
How V-R Toolholder Design Reduces Costly Downtime



1. Insert is clamped in position or released by a turn of the main screw which raises or lowers the exclusive V-R elevator... the single moving part. Nothing to fall out or fumble with.

2. Insert is indexed or replaced in seconds. When you clamp the insert against the chipbreaker plate, it always comes back to the setting, regardless of the thickness of the insert.

3. The main screw is also adjustable from bottom for easy change of inserts when the toolholder is in an inverted position. Another V-R exclusive design feature.



Fastest, easiest-to-use Toolholders manufactured!

The main screw controls the exclusive elevator. The chipbreaker plate forms the top anvil against which the insert is clamped.

TH-616R

Cutting Edges Changed In Seconds . . .

User Reports 55% Production Increase

The toolholder and clamped-in carbide insert principle continues to make major savings everywhere it is applied. Here is a typical recent example:

A Rockford, Illinois, company changed from brazed tools on a turret lathe to a V-R toolholder with throw-away inserts. Grinding of carbide tools for this machine, which formerly took 2 to 3 hours per day, has been eliminated. Machine downtime, formerly about one hour per day, is now about 10 minutes. Production has been increased 20 to 25%!

V-R toolholder design has carried the toolholder principle to maximum effectiveness. A single main screw is the only adjustment. Chipbreaker plates are available ground to a standard chipbreaker width or to a specified width at no extra cost. They are also available with zero chipbreaker width for the customer to grind to his own specifications.

All toolholder parts are interchangeable and replaceable.

Both negative and positive rake holders are available to handle 90% of jobs that can be handled by brazed tools.

On job after job, V-R toolholders have proven to cost less to use than brazed tools or any other toolholder. Investigate—get the facts.

Ask for CATALOG VR-437

Call your V-R Representative or Distributor, or write:

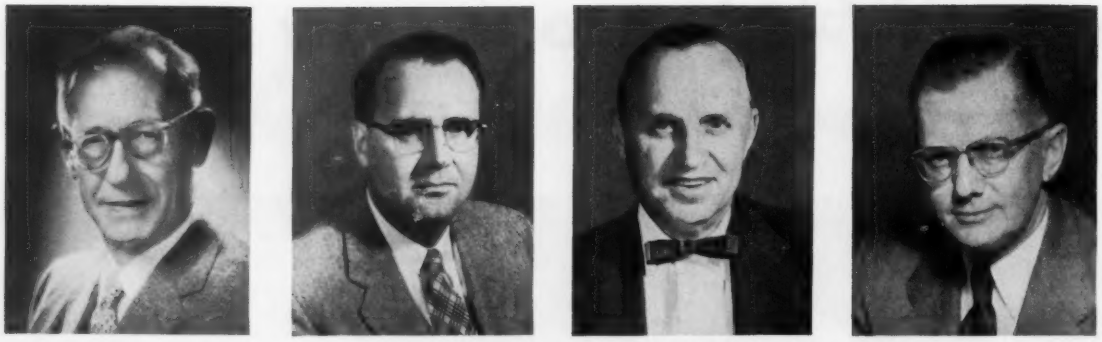
MANUFACTURERS OF:
CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS

Vascoloy-Ramet Corporation

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

810 Market Street • Waukegan, Illinois

For more information fill in page number on Inquiry Card, on page 241



(Left to right) Carl E. Schmitz, executive vice-president; Vance E. Vorhees, vice-president in charge of sales; B. H. Stenberg, vice-president in charge of manufacturing; and E. H. Stubenrauch, assistant to general sales manager of Crane Packing Co.

facilities, and offices in Morton Grove, Ill.; new plants in Houston, Tex., Los Angeles, Calif., and Hackensack, N. J.; and expansion of the Canadian plant in Hamilton, Ontario. New facilities have been purchased in Central Illinois.

OILGEAR CO., Milwaukee, Wis., announces the appointment of EWALD H. PARDUHN as district manager for a newly opened territory office at 6589 Main St., Buffalo, N. Y.

CARL B. WOOTEN was elected executive vice-president of Trecker Aircraft Corporation, a subsidiary of Kearney & Trecker Corporation, Milwaukee, Wis. Mr. Wooten, who has been actively engaged in flying as well as in sales operations with several large aircraft firms since 1934, recently resigned as sales manager of the Aero Design & Engineering Co.

Michigan

PROGRESSIVE WELDER SALES CO., Detroit, Mich., announces three executive appointments: IRVING L. POND was named sales manager of the Frostrode Division—replacing L. F. VAN NORTWICK who has been named general sales manager of the company. Mr. Van Nortwick, in turn, replaces GEORGE W. ENK.

UNIVERSAL VISE & TOOL CO., Parma, Mich., announces acquisition of all manufacturing and sales rights to the integrated machine tool clamping and setup system formerly produced by TECHNO PRODUCTS, INC., Cleveland, Ohio.

CARL J. OXFORD, JR., has been appointed director of research at the National Twist Drill & Tool Co., Rochester, Mich. He will be in charge of laboratory and research activities.

R. L. GREENE has been appointed assistant sales manager, special products sales, supervising all activities in connection with aluminum treatments marketed by Parker Rust Proof Co., Detroit, Mich.

H. PELPHREY has been appointed director of engineering research, Michigan Tool Co., Detroit, Mich. He was formerly research engineer.

JOSEPH J. HAUSER, former sales engineer of Sahlin Engineering Co., Inc., Birmingham, Mich., has been appointed assistant sales manager.

New England

BROWN & SHARPE MFG. CO., Providence, R. I., confirms its divisional policy announced last year and will now have two separate selling organizations operating from its New York office. JOHN H. BIGGS will

Carl B. Wooten, executive vice-president, Trecker Aircraft Corporation

(Left) John H. Biggs, district sales manager, Machine Tool Division; Robert E. Berger, district sales manager, Industrial Products Division, for Brown & Sharpe Mfg. Co.

be district sales manager for the Machine Tool Division. Mr. Biggs has been with the company for almost twenty years. ROBERT E. BERGER has been named district sales manager of the company's Industrial Products Division. Mr. Berger, who was formerly at the company's Providence plant, has broad marketing experience in cutting tools and related industrial product lines.

PRATT & WHITNEY AIRCRAFT, East Hartford, Conn., announces two promotions in the engineering department: PERRY W. PRATT, who joined the company in 1937, has been advanced to the position of assistant engineering manager of the company's main Connecticut operations. With ARTHUR E. SMITH, engineering manager, Mr. Pratt will have broad direction of the company's engineering activities, including the Canel and Florida operations. WILLARD L. GORTON, who has been with the company for twenty years, has been promoted to chief engineer of the company's main Connecticut operations, including the East Hartford facility and its branch plants.

ALLEN MFG. CO., Hartford, Conn., announces the following executive appointments: MALVERN J. MATHER was elected president. He succeeds JAMES G. OSMOND, who is retiring. ELLSWORTH S. GRANT was appointed vice-president in charge of manufacturing. Other officers renamed at the same time were: W. D. HORNER, vice-president in charge of sales; A. W. STERN, treasurer; V. B. JUMP, secretary; and M. CHERNUK, assistant secretary.

PARKER-HARTFORD CORPORATION, Hartford, Conn., announced the promotion of WESSON C. MILLER to sales manager and the appointment of RICHARD G. CAMPBELL as controller.

ERNEST F. DOOLEY has been appointed carbide tool engineer of the Jarvis Corporation, Middletown, Conn.

L. S. MOODY has been appointed manager of the New Product Development Laboratory, Pittsfield, Mass. Dr. Moody will be responsible for conducting research, product development, product design, and application development programs for the department.

JAMES R. KEOUGH has been elected vice-president for manufacturing at Fenwal, Inc., Ashland, Mass. He will have executive responsibility for all manufacturing and purchasing operations for the company's plants in Ashland and Framingham, Mass.

LOVEJOY TOOL CO., Springfield, Vt., has been appointed distributor in this country for Degussit honing stones.

New York

M. NIELSEN was elected president of the Babcock & Wilcox Co., New York City. Mr. Nielsen—executive vice-president for the past two years

M. Nielsen, newly elected president of Babcock & Wilcox Co.

—succeeds ALFRED IDDLES, who is retiring after serving as president since 1948. Mr. Nielsen has been with the company since 1924, and was named a vice-president in 1953 when he assumed charge of all Boiler Division manufacturing.

Stanat Mfg. Co., Inc., Westbury, L.I., N.Y., announces that expansion of its Nuclear Division is scheduled for completion early this spring. S. L. MORRISON will direct the engineering sales activities of this division. ARTHUR B. PALMER will serve as design engineer. Mr. Morrison was formerly associated with Baldwin-Lima-Hamilton Corporation, Western Electric Co., and Kollmorgan Optical Co., and was instrumental in the installation of a multi-purpose press to handle radioactive materials for the Atomic Energy Commission's atomic weapons plant operated by Dow Chemical Co. at Rocky Flats, Denver, Colo.

HENRY R. MERRILL, general sales manager of Behr-Manning Co., Troy, N. Y., Division of Norton Co., has been appointed vice-president in

Henry R. Merrill, vice-president in charge of sales, Behr-Manning Co., Division of Norton Co.

charge of sales. Mr. Merrill has been a director of the coated abrasives and pressure-sensitive tape manufacturing firm since 1954. He serves also on the directorate of Behr-Manning (Canada) Ltd.

UNION CARBIDE AND CARBON CORPORATION, New York City, announces the planned construction of a nuclear research center in Sterling Forest, N. Y., located in the southern part of Orange County approximately forty miles from New York City. At the same time, it was announced that DR. FRANK W. HURD has been named director of research of Union Carbide Nuclear Company, a division of Union Carbide and Carbon Corporation.

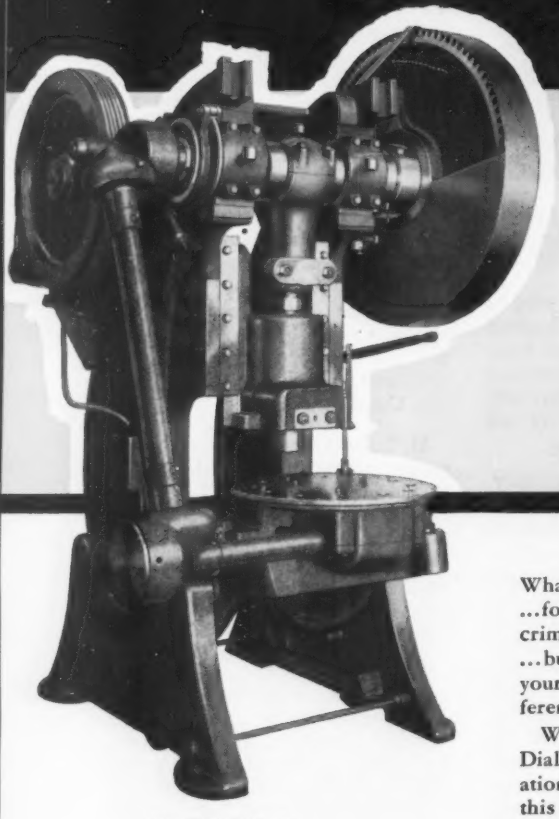
H. T. Ross has been named vice-president—engineering of Linde Air Products Company, a Division of Union Carbide and Carbon Corporation. Mr. Ross has been with the company since 1928 and progressed through the company organization occupying various positions at different locations.

ARTHUR STERNBERG has been appointed general manager of the Solar Permanent Co., a division of U. S. Industries, Inc., New York City. Prior to his appointment, Mr. Sternberg was director of purchasing at Clearing Machine Corporation.

W. JOHN PORTER, JR., engineer for the Hamilton Division of Baldwin-Lima-Hamilton Corporation, has been assigned to the company's New York district sales office.

(This section continued on page 251)

MODERN FEDERAL DIAL FEEDS have what it takes!



No. 7 Dial Feed
Capacity, 80 tons

VERSATILITY plus AUTOMATION

What's the job? Drawing... staking ...forming... piercing... stamping... crimping... punching... broaching ...burring... assembling? Maybe in your plant it's all of them, or a different, unique operation.

We'll lay two-to-one that Federal Dial Feeds are just what your operation needs. For the possibilities of this press with special jigging are practically unlimited. Add automatic feed and ejection and you have the answer to many cost problems.

Modernize now with Federals and eliminate the need for expensive, specialized equipment. Rugged, precision-built Federals embody the finest materials and workmanship. Available in sizes from 6 to 80 tons. *Write for new Dial Feed Catalog.*

THE FEDERAL PRESS COMPANY
701 Division Street, Elkhart, Indiana

FEDERAL DIAL FEED PRESSES

32 Years' Experience in Dial Feed Engineering and Construction

Ohio

JAMES K. WINGARD has been appointed manager of engineering of the Press Division of E. W. Bliss Co., Canton, Ohio. Mr. Wingard has been with the company for over

James K. Wingard, manager of engineering, Press Division, E. W. Bliss Co.

twenty years and has served in various executive engineering capacities. Since 1953, he has been assistant chief engineer of the company's Rolling Mill Division. In his new post, he will be responsible for all press engineering activities.

J. K. GERLACH has been appointed sales manager for the Cleveland Punch & Shear Works Co., Cleveland, Ohio. Mr. Gerlach was formerly connected in a sales capacity with the Cyril Bath Co. and, prior to this, was employed as representative for P. R. Mallory & Co., Inc., Indianapolis, Ind.

J. K. Gerlach, newly appointed sales manager of the Cleveland Punch & Shear Works Co.

DEVILBISS CO., Toledo, Ohio, has announced realignment in the midwestern sales area and appointments of two divisional sales managers. The company's Chicago branch will be headquarters for the north central division under JACK E. KENNEDY as divisional sales manager; the St. Louis branch will be headquarters for the company's Midwestern sales area under the direction of EDWARD F. LUZIUS.

Pennsylvania

ARTHUR S. NIPPES has been named vice-president and general manager of Henry Disston Division, H. K. Porter Co., Inc., Philadelphia, Pa. Before joining the company, Mr. Nippes was with the Elliott Co.

UNITED STATES STEEL CORPORATION's Sales Department, Pittsburgh, Pa., announces the appointments of two assistant vice-presidents: M. M. CHAPMAN, assistant vice-president of sales—distribution, and JOHN R. JOHNSTON, assistant vice-president of sales—solicitation. Both men have served in the company for over thirty years.

BERTRAM A. KLINE has been elected assistant vice-president and sales manager of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. He was formerly sales manager of the company's steel castings and miscellaneous machinery division and general advertising manager since 1953. Mr. Kline has been associated with the company in a sales capacity for more than thirty years.

Bertram A. Kline, assistant vice-president and sales manager, Birdsboro Steel Foundry & Machine Co.

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., announces the following appointments: WILLIAM B. LEARNED was named manager of the company's New Haven, Conn., sales branch. Mr. Learned has been with the company since 1942 and was appointed assistant manager in 1955. He succeeds F. J. DAWLESS, who is serving as sales consultant. GEORGE C. BENEDICT has been named assistant manager, the position previously held by Mr. Learned.

Coming Events

MAY 20-23—AMERICAN SOCIETY OF MECHANICAL ENGINEERS Second Design Conference to be held in conjunction with DESIGN ENGINEERING SHOW at the New York Coliseum. Exhibits will show products which go into the making of other products. These include mechanical, electrical, hydraulic, and pneumatic components; metallic and non-metallic materials; fasteners; finishes and coatings, shapes and forms; and accessories to product development. Further information may be obtained from Clapp & Poliak, Inc., 341 Madison Avenue, New York 17, N. Y.

JUNE 11-14—Annual Cornell University Industrial Engineering Seminars sponsored by the Department of Industrial and Engineering Administration, Sibley School of Mechanical Engineering, Cornell University to be held at Ithaca, N. Y. There will be a series of seminar discussions led by specialists from both industry and the staff of Cornell University. Additional information can be obtained from Andrew Schultz, Jr., Department of Industrial and Engineering Administration, Cornell University, Ithaca, N. Y.

JULY 29-AUGUST 2—Annual Sales Conferences of Sales Executives, Advertising Managers, and Sales Engineers of member companies of the NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION and the AMERICAN TOOL DISTRIBUTORS' ASSOCIATION to be held at Cornell University, Ithaca, N. Y. For further information contact Hill & Knowlton, 323 Republic Building, Cleveland 15, Ohio.

New Cross Plant Built Specifically to Produce Automation Machinery

The new $6 million factory and office building of The Cross Company is said to be the first facility in this country created solely for the production of automation machinery. This plant—located on a 67-acre plot at 17801 E. Fourteen Mile Road, Fraser, Mich., on the outskirts of Detroit—completes the first phase of the company's long-range expansion program. Present capacity is for an annual sales volume of $15 million, and floor space will permit an eventual increase to a $25 million volume.

Advanced concepts in organizing and programming work have been integrated with the latest manufacturing techniques to provide maximum efficiency. Among the many plant features are: simulated line production, a data processing department with a Univac high-speed electronic computer, and a novel engineering setup that provides inter-company competition for engineering ideas. An illuminated plastic sub-ceiling provides 125 foot-candles of light throughout the building. Air temperature and humidity are controlled the year round.

The data-processing department is one of the highlights of the office. With its Univac electronic computer it calculates and records the entire payroll, distributes direct and indirect labor, provides weekly reports on past due machine work and individual machine loads, provides shortage reports for assembly and progress reports on individual orders, and performs other functions.

The engineering department is organized and the offices are arranged to develop inter-company competition for optimum performance. The department is divided into sections which are operated by engineering managers like separate businesses, subject only to the guidance of the engineering vice-president. In another part of the office is an engineering school, which is currently graduating sixteen draftsmen per year. It is expected that the school will provide the engineers needed for the company's continuing growth.

The factory is laid out to provide simulated line production. Material is received at the front of the factory building, moves through machining lines, and is assembled and shipped at the rear. The main part of the building comprises three 60-foot bays, 700 feet long. The three bays are used to house the heavy, medium, and light machining lines as well as assembly. To eliminate back tracking of materials, certain types of machines are duplicated. For example, horizontal boring mills are found in both the medium and heavy lines, and radial drills are found in all three lines. When the parts are complete they must pass through an inspection zone that spans the middle of the plant.

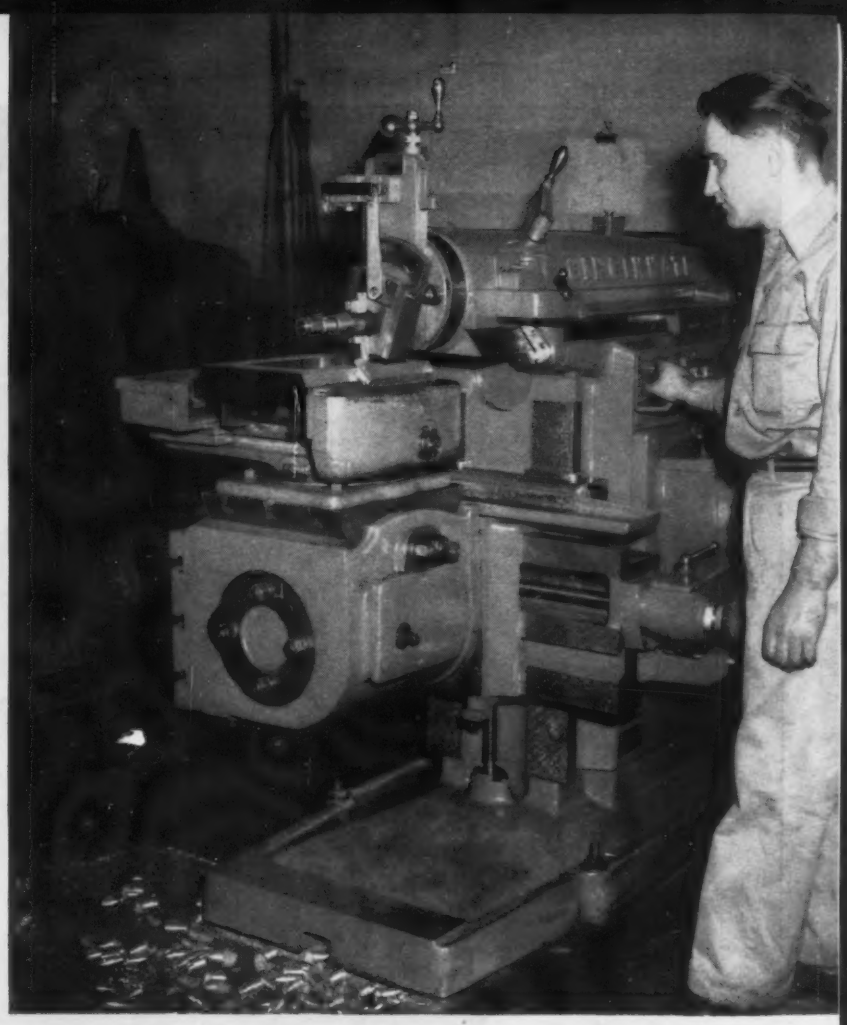
Stockroom and material banks follow the inspection area, after which come three assembly floors and the shipping well at the end of the building. Trucks drive straight through the shipping well and can receive machines from all three assembly floors simultaneously, if necessary. For assembling and testing large transfer machines that employ coolant, a special area has been set aside with a central pumping system. Cross sectionized Transfermatics up to 300 feet long can be accommodated on two of the assembly floors, or as many as fifteen transfer machines can be in assembly at the same time. Adjacent to the heavy machining line on the west side of the building are additional quarters which house the casting cleaning room, the heat-treating department, maintenance, and liaison engineering.

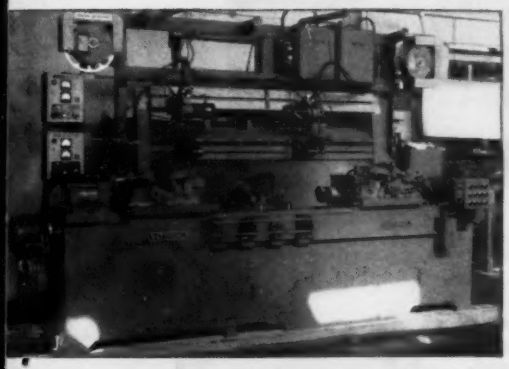
Heavy machine line in the new Cross plant. Material flows through the machines in foreground, then through an inspection area, and is assembled and shipped at the rear.

Accurate heavy cuts by this Cincinnati Rigid Shaper

. . . at NATIONAL ELECTRIC WELDING MACHINES CO.

Bay City, Michigan





The steel slide being machined will be used on a National Automatic MIG arc welder, such as shown above.

Economical production of this steel slide for an automatic arc welder requires heavy cutting with maintained accuracy. The machine chosen for this job is a 16" Cincinnati Heavy Duty Rigid Shaper. Some of the features which make this performance possible are:

- Extreme rigidity due to heavily ribbed column.
- Exclusive Cincinnati 50 PSI pressure lubrication.
- Maximum accuracy due to extended ram bearing and slot-free ram.
- Fast, easy operation due to electro-magnetic brake and clutch with finger-tip control.

Write **Department D** for Bulletin "CINCINNATI RIGID SHAPERS". We also suggest you consult our Application Engineering Department on your machining problems.

Photos courtesy National Electric Welding Machines Co., Bay City, Michigan.

CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

Reg. U.S. Pat. Off.

BATH PRESSES can TAKE IT... Around the Clock!

The Fort Steuben Metal Products Co., Follansbee, West Virginia specializes in the fabricating of anything in the metal shelving line.

Mr. Albert W. Robinson, Vice President of the Fort Steuben Metal Products Company has this to say about Bath Presses:

"Here at Fort Steuben we are more than satisfied with the way Cyril Bath Presses have demonstrated their ability to take it. Operating as we do, sometimes around the clock to keep up with demand for our shelving, we require dependable, rugged equipment. This ruggedness, coupled with large bed area for dollars expended, plus ease of operation and maintenance makes Cyril Bath Presses ideal."

Catalogs are available, without obligation, covering both The Cyril Bath Power Press Brake and P.T. Press line . . . this literature covers important information regarding the features which make BATH Presses your best buy . . . and ask for the Power Press Brake Die Catalog too!

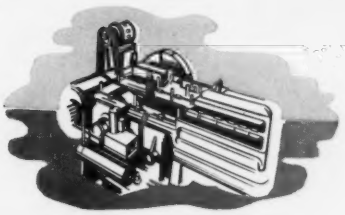
THE CYRIL BATH COMPANY

32324 AURORA ROAD • SOLON, OHIO

(LOCATED IN THE GREATER CLEVELAND AREA)

Manufacturers of Radial Draw Formers • Dies • Tools • Press Brakes • Tangent Bending Sequence Presses • Press Type Brakes • Special Machines

For more information fill in page number on Inquiry Card, on page 241



"For three weeks their production was zero"...

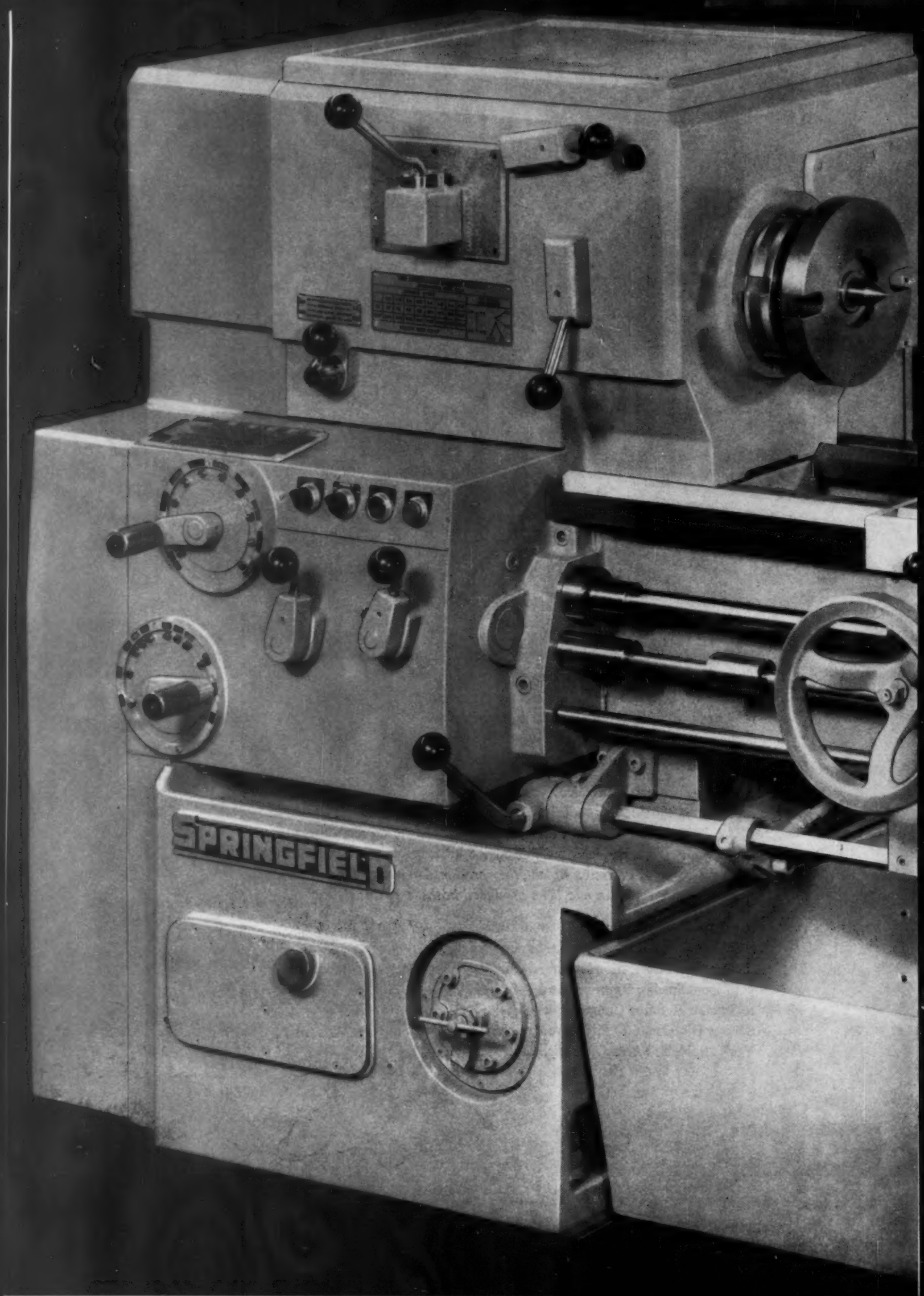
A midwest plant was faced with a serious production problem in aluminum extrusion. The operation, on a ⅜" cold upset extruder, was to form a clinching cap for a metal screw. In three weeks of experimentation they did not produce one acceptable product, although they had tried a variety of piercing tool lubricants, including both oil and wax.

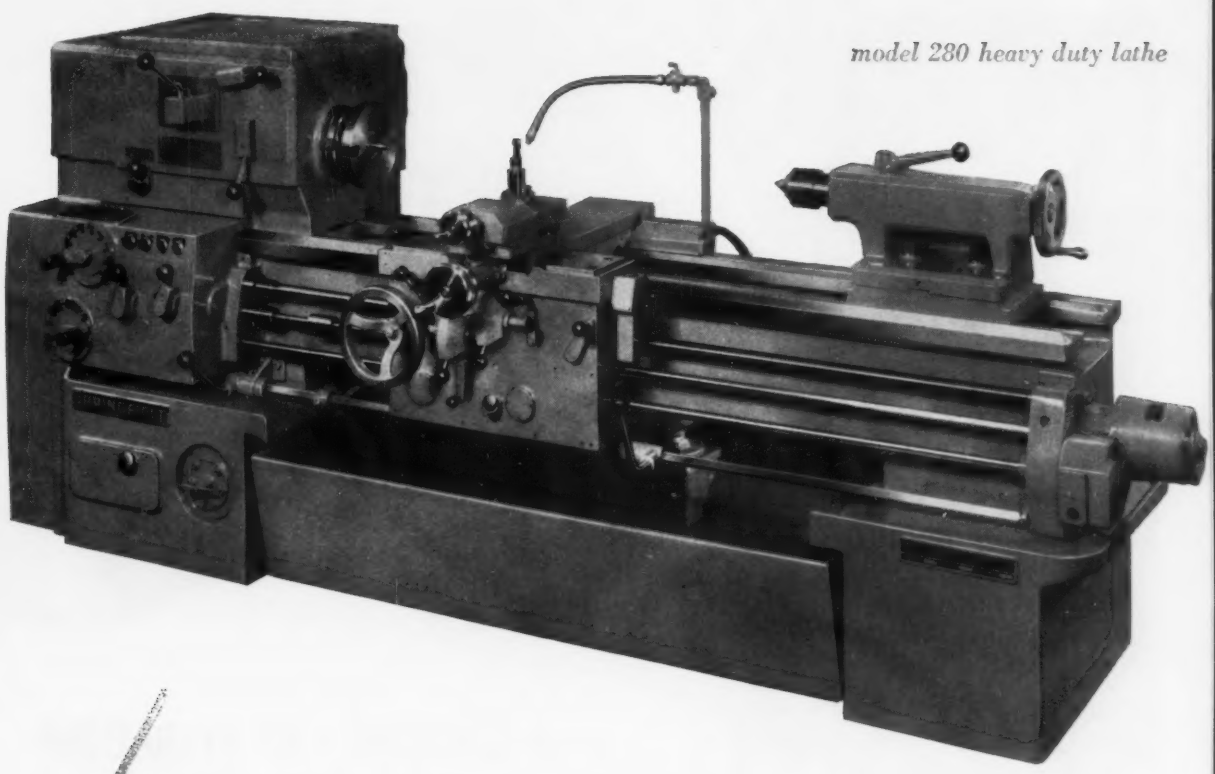
The plant foreman called in J. V. Ritz, a Sinclair Area Engineer. Mr. Ritz reports: "After studying their lubrication problem, I decided that Sinclair TRUKUT,® used in the neat form, would provide the correct lubrication. Three hours after they followed this advice, their machine was producing perfect caps at full capacity. *In fact, they produced more caps in a twenty-minute run than had been produced in the previous three weeks.*"

If you have a lubrication problem in your machining operation, call on the experience of a Sinclair Lubrication Engineer. Contact your local Sinclair Representative, or write to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation.*

SINCLAIR

CUTTING OILS and COOLANTS


SPRINGFIELD



model 280 heavy duty lathe

it does more work for less money

Springfield is proud to present a new heavy-duty 16″ engine lathe, the Model 280. It offers high horsepower—10, 15 or 20 hp—for heavy cuts, clean design, and ease of operation, all at a reasonable price. Direct simplicity and straightforward design assure low maintenance cost.

It has no electronic brain, because Springfield believes that most of today's jobs still require craftsmanship of the human variety. In the Model 280 the price is for the tool, not the brain.

Only the gears necessary for a given speed are in mesh. Sixteen speeds to choose from, 60 feeds and threads—available instantly to any operator. Unique sealed oil spray lubricates and cools gears. It's the lathe most easily converted to contouring and reproducing with accessories, without budget strain. If you're in the quality market for a new heavy-duty lathe that still respects the contribution of craftsmanship, the Model 280 is for you. Basic price FOB Springfield, Ohio, $8,013.

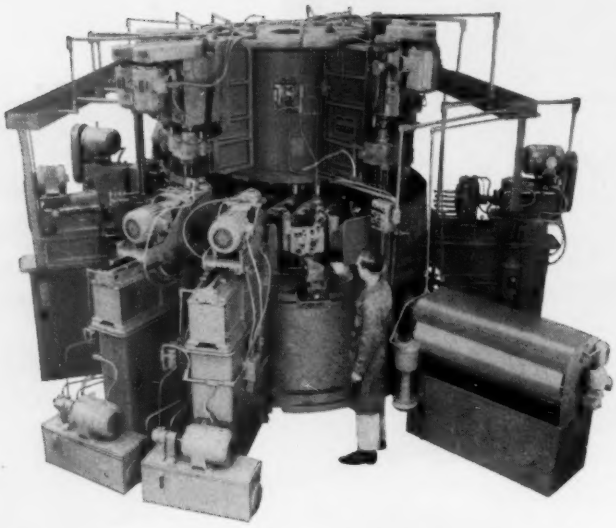
The Springfield Machine Tool Company
Springfield, Ohio

68TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

SPRINGFIELD

Eliminates model change-over problems!

a production machine—with standard units—quick change-over features—for each year's design change. completely automatic—requires only part loading and unloading.



• 18 STATIONS • 47 OPERATIONS • 120 PARTS/HOUR

The new intricate production giant shown above is also a triumph in metalworking flexibility. Designed for a leading appliance manufacturer, the MORRIS Model 334-S High Production Machine processes one-cylinder or two-cylinder housings at the rate of one every 30 seconds.

Yet there's no model change-over problem! The MORRIS completely automatic "special" machine uses a MORRIS basic center column machine equipped with an 84" dia. table, an 18-station automatic hydraulic index, and MORRIS Unit-Type Machine Tools.

A total of 47 spindles, mounted on three 8-inch way type units, six No. 2 CAM-MATIC Drill Units and eight AIR-OIL-MATIC Drill Units, are used to mill, drill, counterbore, spot face, bore, ream and tap housings.

The result . . . a "special" machine at a fraction of the usual special machine cost . . . accurate, flexible, fast!

Write for new detailed descriptive literature . . . or outline your mass production problem involving drilling or related operations for prompt attention by MORRIS engineers.

MORRIS AIR-OIL-MATIC DRILL UNITS

- Adjustable Feed, Stroke and Rapid Approach
- Trouble-free Hydraulic System
- Wide Range of Spindle Speeds • Convenient Controls
- Air or Oil Powered • Hydraulically Controlled

Designed for a wide range of drilling, reaming, chamfering, spot-facing, hollow milling, centering and related operations, the unit can be mounted in vertical, angular or horizontal positions. Controls may be set to provide almost any sequence of operation. Available for use in special purpose machines like the production machine illustrated.

NOW AVAILABLE EQUIPPED FOR GUN DRILLING

. . . with infinitely variable spindle speeds and feeds; speeds to 8,000 r.p.m., feeds to 40 inch/min. with 6 inch or 9 inch stroke. Sliding base available for 6 or 9 inch movement. Write for details.

Morris

THE MORRIS MACHINE TOOL CO.
946 HARRIET STREET . CINCINNATI 3, OHIO

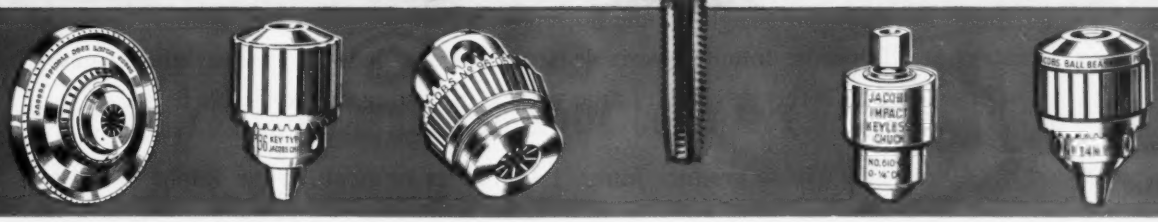
For more information fill in page number on Inquiry Card, on page 241

Jacobs
CHUCKS

Superior performance is the result of the painstaking production of superior parts.

Jacobs and your industrial supply distributor deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

The Jacobs Manufacturing Company
West Hartford, Connecticut



The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.

The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.

The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.

The Jacobs Rubber-Flex® Tap Chuck designed for tapping heads and impact tools.

The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.

The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use.

Find out whether this new machine will bore your parts 3 to 8 times faster!

Parts with long holes . . . or identical parts,

The new LeBlond-Carlstedt Rapid Borers solid bore, trepan or counterbore holes 3 to 8 times faster than by the conventional D-bit method! *Hole capacity from 5/16" to 4-1/4" diameter.* Basically, the Rapid Borer is suited to work that is symmetrical for balance in rotation—round, square, octagonal, tapered or stepped. A wide variety of hole diameters and depths as well as work sizes can be handled.

The Rapid Borer was developed expressly to accommodate revolutionary new tooling which cuts at very high speed with good accuracy and finish. Cutting oil at high pressure is forced between the boring bar and hole wall forming a continuous bearing. It flushes back through a hole in the boring head and bar, carrying away the chips as it goes. Chip form is controlled both by tool angles and proper feed and speed combinations; thus tool faces are kept clean and chip passage clear. Cutter design produces balanced cutting pressures thereby controlling concentricity.

This new tooling requires a machine with the following characteristics, all of which are incorporated in the LeBlond Rapid Borer design—High spindle horsepower; Ample rigidity throughout; Complete absence of vibration at all speeds; Infinitely-variable feeds, independent of speeds, while running under load; Final drive to spindle through belts; Large volume of cutting oil. Available in 3 sizes, No. 15, No. 30 and No. 60.

Tell us about the holes you'd like to produce faster. Large holes or small. If the Rapid Borer can handle the job, we'll show you how to produce them faster than ever before. Other equipment available for holes larger than 4¼".

THE R. K. LEBLOND MACHINE TOOL COMPANY
Dept. D. Cincinnati 8, Ohio

Gentlemen:
We want to know if your Rapid Borer really will bore our part 3 to 8 times faster. Here's a description of the job.

*Size of hole to be bored*_____

*Length of hole to be bored*_____

*Annual production of parts*_____

*Material and Hardness*_____

Conformation of part and dimensions (send sketch or print)

Name_____

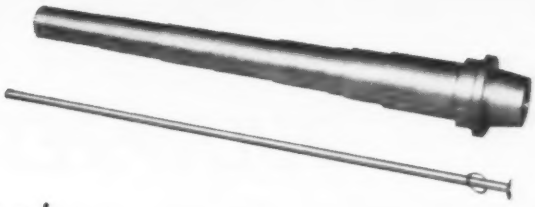
Title_____

Company_____

Address_____

City_____ State_____

bored as one piece, then cut apart.



These tremendous production savings can be yours!

Rapid Borer Time: 5.2 minutes
D-Bit Time (old method): 41.5 minutes
Hole diameter . . . 1-17/32"
Hole length . . . 31¼"
Part material . . . C-1141 Hot Rolled 187 Brinell
Part outside diameter . . . 2.450" at small end, 2.710" at large end.
Feed rate (solid bore) . . . 6" per minute

Rapid Borer Time: 17.75 minutes
D-Bit Time (old method): 86 minutes
Hole diameter . . . 2-3/16" Core diameter . . . .852"
Hole length . . . 53¾"
Part material . . . 4140 Forging 200 Brinell
Part outside diameter . . . 3.455" at small end, 4.425" at large end.
Feed rate (trepanning) . . . 3" per minute

For complete information write for Bulletin LC 501D

THE R.K. LeBLOND MACHINE TOOL COMPANY

Cincinnati 8, Ohio

World's Largest Builder of a Complete Line of Lathes for more than 70 years

LeBLOND of Cincinnati

A Multipress case study

Small lot production of intricate electronic parts is performed quickly and economically on this Denison hydraulic Multipress.

MULTIPRESS® speeds electronic parts assembly at General Radio

The Problem: Planning a production set-up for a company that averages a new, complex electronic instrument every month, in production lots ranging from 50 to 100,000 units.

The solution: Denison's versatile hydraulic Multipress.

General Radio Company of Cambridge, Mass., a leading designer and manufacturer of electronic test equipment, finds Multipress capable of automatic operations on volume runs, yet efficient when manually operated for small lots.

Small lot production costs have been reduced substantially. Operator safety is at peak levels. Smooth, precise pressure control produces uniform assemblies despite thickness variations in stock materials.

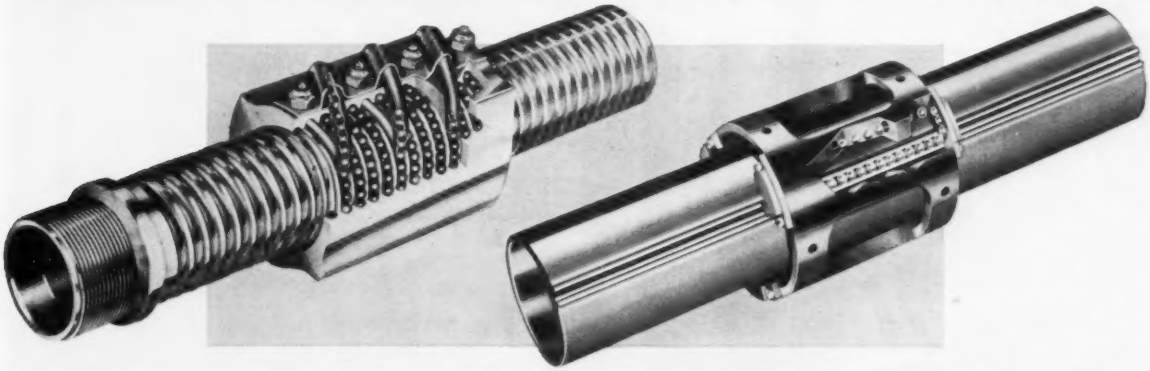
These Multipress benefits are typical. To find out how Denison hydraulic power can lower costs, speed production and improve quality for your company, consult a Denison hydraulic specialist. Write Denison Engineering Division, American Brake Shoe Co., 1244 Dublin Road, Columbus 16, Ohio.

DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

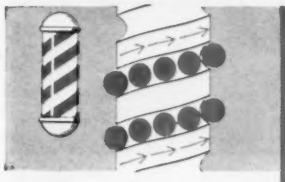
These MODERN Recirculating Ball Units can help you...

SOLVE ACTUATION and TORQUE PROBLEMS

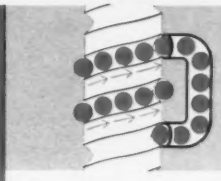


Saginaw b/b Screws guaranteed 90% efficient —offer 6 major advantages for designers

Available in custom machined and commercial rolled thread types—have been built from 1½ inches to 39½ feet long—⅜ to 10 inches diameter.



Nut *glides* on steel balls. Like stripes on a barber pole, the balls travel toward end of nut through spiral "tunnel" formed by concave threads in both screw and mating nut.



At end of trip, one or more tubular guides lead balls diagonally back across outside of nut to starting point, forming closed circuit through which balls recirculate.

1 VITAL POWER SAVINGS. With guaranteed efficiency of 90%, Saginaw b/b Screws are up to 5 times as efficient as Acme screws, require only ⅕ as much torque. This permits much smaller motors with far less drain on the electrical system. Circuitry is greatly simplified.

2 SPACE/WEIGHT REDUCTION. Saginaw b/b Screws permit use of smaller motors and gear boxes; eliminate pumps, accumulators and piping required by hydraulics. In addition, Saginaw b/b Screws themselves are smaller and lighter. Units have been engineered from 1½ in. to 39½ ft. in length.

3 PRECISE POSITIONING. Machine-ground Saginaw b/b Screws offer a great advantage over hydraulics or pneumatics because a component can be positioned at a predetermined point with precision. Tolerances on position are held within .0006 in./ft. of travel.

4 TEMPERATURE TOLERANCE. Normal operating range is from −75° to +275° F., but assemblies have been designed in selected materials which function efficiently as high as +900° F. These units are practical where hydraulic fluids have lost efficiency or reached their flash point.

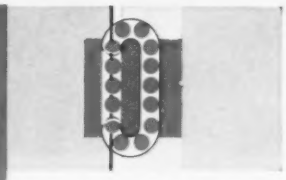
5 LUBRICATION LATITUDE. Even if lubrication fails or cannot originally be provided because of extreme temperatures or other problems, Saginaw b/b Screws will still operate with remarkable efficiency. Saginaw units have been designed, built and qualified for operation without any lubrication.

6 FAIL-SAFE PERFORMANCE. Far less vulnerable than hydraulics. In addition, Saginaw offers three significant advantages over other makes: (1) Gothic arch grooves eliminate dirt sensitivity, increase ball life; (2) yoke deflectors and (3) multiple circuits provide added assurance against operating failure.

Saginaw b/b Splines average 40 times lower friction coefficient than sliding splines

Transmit or restrain high torque loads far more efficiently—have been built from 3 inches to 10 feet long—⅜ inch to 6 inches in diameter.

The *Saginaw b/b Spline* radically increases the efficiency of transmitting or restraining high torque loads. Instead of *sliding* against each other, surfaces *glide* on rolling balls.



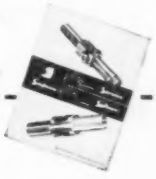
The steel balls recirculate in closed circuits formed by mating longitudinal raceways spaced around the circumference of inner and outer splines. Guides return balls.

This revolutionary new kind of spline utilizes the same basic principle pioneered by Saginaw in the ball/bearing screw.

It permits new engineering designs never before practical—literally lets you achieve the "impossible"! In any application where column length must change under torque load, the Saginaw b/b Spline offers greatly decreased friction, less wear, longer life, more dependable operation. It can be fitted with integral gears, clutch dogs, bearing and sprocket seats or a wide choice of other attachments for use with electric, hydraulic or pneumatic units. To convert push-pull to rotary motion, helical types are available with very high leads, ranging from 20:1 to 100:1.

SEND TODAY FOR THIS FREE 1957 ENGINEERING DATA BOOK...

or see our section in Sweet's Product Design File



Saginaw Steering Gear Division
General Motors Corporation
b/b Screw and Spline Operation
Dept. 4Y, Saginaw, Michigan

Please send new engineering data book on Saginaw b/b Screws and Splines to:

NAME _____

COMPANY _____ TITLE _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Saginaw ball bearing Screws and Splines

SAGINAW STEERING GEAR DIVISION OF GENERAL MOTORS
WORLD'S LARGEST PRODUCER OF BALL BEARING SCREWS AND SPLINES

For more information fill in page number on Inquiry Card, on page 241

Photo courtesy 20TH Century Mfg. & Supply Co., Tulsa, Oklahoma

"We are extremely proud of the job our PORTAGE mills are doing"

The Portage Machine Co.
Akron, Ohio

Gentlemen:

Our business, as you know, is Contractors of Metal Products. This particular job is a steel forging being machined, and when finished will be a fluid cylinder for a high pressure pump used in the oil industry. These forgings are made from AISI-4140 steel and we are extremely proud of the job PORTAGE mills are doing.

We find our PORTAGE mills very accurate. These mills must repeat themselves in each location and operation often during the machining operation. Specifications call for very close tolerances and we have no trouble in doing this precision work.

Yours truly,
20TH Century Mfg. & Supply Co.

R. G. Galloway
President

THE Portage MACHINE CO.

1036 Sweitzer Avenue • Akron 11, Ohio
Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

For more information fill in page number on Inquiry Card, on page 241

NEW *Synduction* MOTOR

Do you have an Application Requiring . . .

. . . **Constant speed, regardless of load or voltage, depending only on frequency.**

. . . **Synchronized speed for a number of motors.**

. . . **Adjustable speed with minimum variation at any speed setting.**

Synchronous Speed with Induction Simplicity

Allis-Chalmers new development — the *Synduction* motor — offers these characteristics at low cost — with the dependability of an induction motor. In addition to constant speed from no load to pull-out, it also offers across-the-line starting, wide range of speeds and high efficiency. It's another example of MORE motor pioneering by Allis-Chalmers.

Allis-Chalmers invites your inquiry, in the belief that many processes can be improved by the application of *Synduction* motors. Our engineers will gladly analyze your present operations to help you determine where *Synduction* motors can be applied profitably. Call your A-C office or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin, for Bulletin 51B8440.

Synduction is an Allis-Chalmers trademark.

A-5115

ALLIS-CHALMERS

ORANGE *Cage Type* NEEDLE BEARINGS

are true running in any position

VERTICAL . . . . TILTED . . . . . HORIZONTAL

Cage assures permanent alignment of rollers

Each needle roller is retained in pockets of a cage made of anti-friction, non-ferrous metal. These pockets guide and align the rollers along their entire length. The cage does not wear on the rollers, since the cage land rides on the outer race. Square end rollers provide maximum effective roller length.

The Rollers Roll evenly — never Skew or Slide

Kingsbury Machine Tool Corp. uses Orange Cage Type Needle Bearings to align the vertical spindles in the drill heads of Kingsbury Indexing Automatics, to meet small space and precision operating requirements.

The non-skewing, aligned roller action of Orange Cage Type Needle Bearings adds many additional advantages to the high-load, small-space characteristics of conventional needle bearings.

For example: Less internal friction—quieter running—meet higher precision requirements—operate at higher speeds—may be used on overhung mountings—less affected by misaligned mountings or uneven loading—longer life expectancy.

Orange Cage Type Needle Bearings are available in stock sizes from ½" to 8" dia., interchangeable with all standard needle bearings. Write for Engineering Manual M-56.

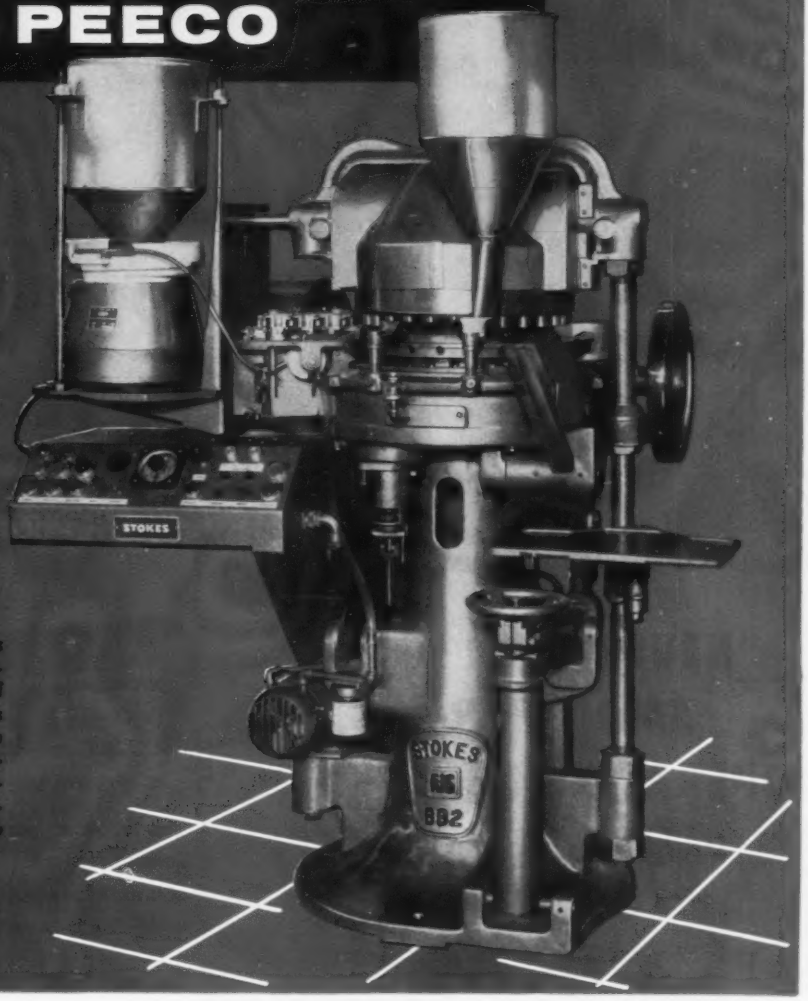
See the complete line of Orange Roller Bearings at BOOTH 531 Design Engineering Show

ORANGE ROLLER BEARINGS

ORANGE ROLLER BEARING CO., Inc.
552 Main Street, Orange, N. J.

Needle Bearings — Staggered Roller Bearings
Journal Roller Bearings — Thrust Roller Bearings
Cam Followers

production equipment produces MORE with PEECO



STOKES

NOW developed PEECO feeders are included on STOKES pharmaceutical equipment. The Model 538 Mark II (illustrated) produces press-coated tablets with a high degree of uniformity and precision at rates up to 750 per minute. Tablet cores are fully oriented, without dusting within the PEECO feeder bowl.

PEECO'S leadership in the field of vibratory parts feeders has contributed much in helping increase the capacities of new production equipment in various markets. We are glad to include among the companies now being served by PEECO, F. J. Stokes Corporation of Philadelphia, Pennsylvania, manufacturers of pharmaceutical equipment for two-thirds of a century.

If you want to produce more, send for bulletin No. 365 and ask for the name of the PEECO representative in your area.

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF VIBRATORY PARTS FEEDERS

Peeco PERRY EQUIPMENT & ENGINEERING CO.

ERIE, PA. • A DIVISION OF AUTOMATION DEVICES, INC.

A·D

For more information fill in page number on Inquiry Card, on page 241

Series No. 4B12 Steelweld Shear. With more than a half century of experience in steel warehousing, Enos & Sanderson know what good shearing is. They are proud of this machine. They advertise that: "Trained shearing teams will give you the finest edge ever cut with this Steelweld".

"NEVER SEEN A *SMOOTHER* OPERATING SHEAR"

Steel Warehouse Elated with Steelweld Shear

For 57 years The Enos & Sanderson Company, Buffalo, N. Y. has been supplying steel sheets and plates to hundreds of Niagara Frontier factories. Recently they installed a Steelweld Shear in their new warehouse. This is used for cutting various thicknesses to 1/4" x 12', as per customer orders. Cuts must be smooth, straight and accurate. Speed is essential to provide best service possible.

Enos & Sanderson's new 35,000 sq. ft. steel warehouse

The following paragraph in an unsolicited letter from Enos & Sanderson indicates how well their Steelweld Shear is serving their needs:

"We are extremely satisfied with the operation of this unit and would recommend this machine highly to anyone. A rigger, who set up this shear for operation, remarked that, in his twenty-five years of work with shears of all types, he had never seen a smoother operating shear in his experience."

THE CLEVELAND CRANE & ENGINEERING CO.
5435 East 282 Street, Wickliffe, Ohio

STEELWELD PIVOTED BLADE SHEARS

Heller nucut®

LONG ANGLE LATHE FILE

gives smoothest finish ...stays sharp longer!

Look at the long 45° angle of those super-sharp precision-cut teeth. It means greater shearing action for removing metal faster and with less pressure without clogging. The long angle provides a self-cleaning action — new chips clear out the old. This special-purpose file is cut from a heavy blank for extra strength and better results on lathe work. Both edges are "safe" to protect work shoulders. It can be used to give the right finishing touch to both hard and soft metals.

You can depend on Heller Nucut Long Angle Lathe Files to speed work and cut costs. A trial is the best convincer.

SOLD *EXCLUSIVELY* THROUGH

Heller DISTRIBUTORS

"YOUR OUTSIDE TOOL ROOM"

Heller *"Job Tempered"* Tools

A job-proved Heller product!

HOLLER for HELLER ...*and be* SATISFIED!

CHOOSE THE RIGHT FILE FOR THE JOB! Heller research and over a century of manufacturing experience have been responsible for many of the most practical file developments in the field today. That's why you'll find the *right* files for your jobs among the thousands of types, sizes, shapes, and cuts that make up the Heller AMERICAN PATTERN, SWISS PATTERN, VIXEN, and ROTARY FILE lines.

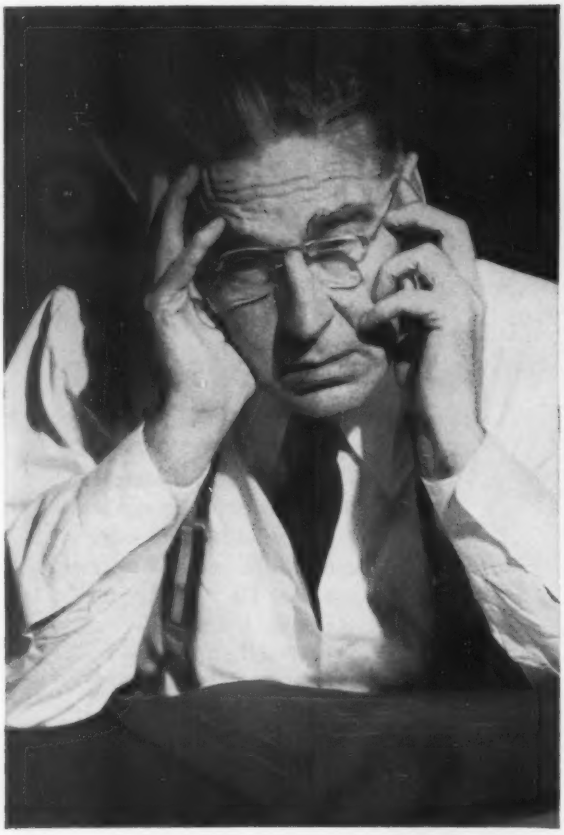
GET LONGER FILE LIFE! All Heller Files are "Job Tempered" by a unique combination of metallurgical and hardening techniques. That's why Heller files cut faster and last longer . . . are favored by filers everywhere!

MORE ON-THE-JOB HELP! Heller's Representatives . . . backed by more than 100 years' problem-solving experience . . . are best equipped to fit the right files to new designs and materials. This valuable technical service is yours for the asking . . . through your nearby Heller distributor.

Heller Tool Co.

America's Oldest File Manufacturer
NEWCOMERSTOWN, OHIO
Subsidiary of Simonds Saw and Steel Co.

For more information fill in page number on Inquiry Card, on page 241



send it out to CDT

There is no faster, more reliable way to get help with difficult tooling problems than to send it to Columbus Die-Tool. Backed by 50 years of experience, CDT has three basic objectives when designing and building tools, jigs, fixtures or special machinery.

1. Increase Production
2. Improve Quality of Product
3. Lower Production Costs

These and other benefits are reasons why so many of the nation's leading manufacturers regularly avail themselves of the specialized services of Columbus Die-Tool. Perhaps we can solve your tooling problem and help you make your product . . . better, for less.

Columbus Die-Tool
AND MACHINE COMPANY

P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

The Lepel line of induction heating equipment represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating.

If you are interested in induction heating you are invited to send samples of the work with specifications. Our engineers will process and return the completed job with full data and recommendations without any cost or obligations.

TYPICAL INDUCTION HEATING APPLICATIONS

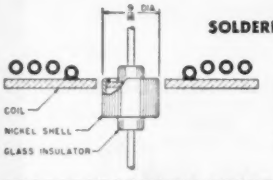
HARDENING DIESEL FUEL INJECTOR

Restriction of heat to end of holder body for fuel injector permits hardening of face to provide required resistance to deformation without hardening the threads. Coil design shown provides uniform temperature for hardening despite holes in face.

REMOVING RUBBER FROM STEEL

Induction heating develops uniform temperature at steel-rubber interface destroying bond for easy separation. Steel and rubber may similarly be salvaged from mounting brackets, shock absorbers, etc.

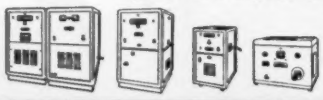
SOLDERING TRANSISTOR ASSEMBLIES



Concentrator-type coil creates high intensity, restricted heating at joint of nickel shell and tinned glass, thus causing solder flow for permanent seal.

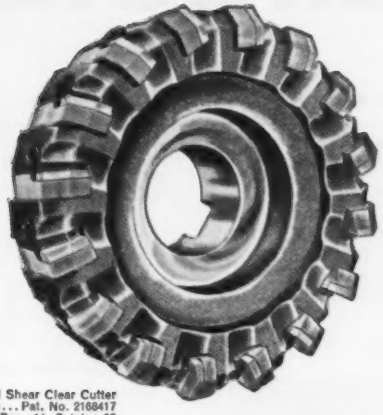
Electronic Tube Generators from 1 kw to 100 kw.
Spark Gap Converters from 2 kw to 30 kw.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.



All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.



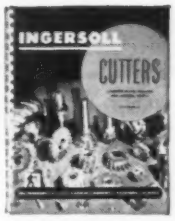
Ingersoll Shear Clear Cutter
27600 series... Pat. No. 2168417
Page 14, Catalog 66

Feed rate increased 2½ to 5 times at Vaughn with this INGERSOLL SHEAR CLEAR® CUTTER

The cutter previously used was nullifying the investment in a new standard, knee-type milling machine. The machine had more power than was being utilized. The feed rate was only 12″ per minute. The change to Ingersoll Shear Clear permitted the Vaughn Machine Company, Cuyahoga Falls, Ohio, to capitalize on its machine investment and obtain the economy and efficiency of increased feed rate. A feed range of 30″ to 60″ per minute, when milling rough forgings and steel castings, is now continuously maintained.

Ingersoll inserted blade cutters are used on all makes of machines for milling and boring a wide range of materials. An Ingersoll Cutter Division representative will be glad to discuss this and other feed rate experiences with you.

Whether you are concerned with feed rates, longer tool life, finish or cutter costs, the new Ingersoll cutter catalog will be a valuable guide. Write Department 66B.



Use this new 82 page guide for selecting the right inserted blade milling and boring cutters for your work. Write for catalog #66, today.

Representative Ingersoll Customers in Diversified Industries

ADAMSON UNITED CO.

ALLIS-CHALMERS MFG. CO.

BLAW-KNOX COMPANY

E. W. BLISS COMPANY

BUCYRUS-ERIE COMPANY

CHASE BRASS & COPPER COMPANY, INC.

CLARK EQUIPMENT CO.

THE CLEVELAND PUNCH & SHEAR WORKS COMPANY

THE COOPER-BESSEMER CORPORATION

CROSS COMPANY

THE EIMCO CORPORATION

ELECTRO-MOTIVE DIVISION

FEDERAL ENGINEERING CO.

HERCULES MOTORS CORP.

LINK-BELT COMPANY

LUFKIN FOUNDRY & MACHINE COMPANY

PRATT & WHITNEY COMPANY, INC.

THE PRODUCTO MACHINE COMPANY

RYAN AERONAUTICAL CO.

SIMONDS SAW & STEEL CO.

WAYNE DIE & TOOL CORP.

CUTTER DIVISION

THE INGERSOLL MILLING MACHINE COMPANY

ROCKFORD ILLINOIS

For more information fill in page number on Inquiry Card, on page 241

Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Niagara Falls, N. Y.
Crane Packing Co., Morton Grove, Ill.
Gardner Machine Co., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ABRASIVES, Discs
Carborundum Co., Niagara Falls, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Niagara Falls, N. Y.
Crane Packing Co., Morton Grove, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
Erie Foundry Co., 1253 W. 12th St., Erie, Pa.
Watson-Stillman Co., Roselle, N. J.

AIR GAGES, Dimensional—See Gages Air Comparator

AIR GUNS
Chicago Pneumatic Tool Co., New York 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic Drills, Portable, Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer Toledo 1, Ohio
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron, Mich.

ALLOYS, Non-ferrous—See Brass, Copper, Zinc and Stellite

ALUMINUM and Aluminum Products
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

ANGLE PLATES—See Set-Up Equipment

ANNEALING FURNACES
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.
General Electric Co., Schenectady, N. Y.

Every Circle R slitter is a "special" — made right, to do a specific job best in slitting textile metallics, sheet steel, rubber, brass, sand paper, etc. For efficiency in slitting any substance, consult your Circle R representative!

Burbank
Chicago
Cleveland
Dayton
Detroit
Hackensack
Indianapolis
Kansas City
Milwaukee
New York City
Philadelphia
Montreal
Phoenix
Pittsburgh
Providence
Rochester
St. Louis
Westbury, L. I.

SEND FOR CATALOG O

CIRCULAR TOOL CO., INC.
PROVIDENCE 5, RHODE ISLAND
Specialists in Circular Cutting Tools Since 1923

METAL SLITTING SAWS
COPPER TUBING SAWS
SCREW SLOTTING SAWS
COMMUTATOR SLOTTING SAWS
JEWELERS SLOTTING SAWS
CUT OFF SAWS • CIRCULAR KNIVES & ROTARY SHEAR BLADES • CIRCOLOY STEEL SAWS • SOLID & TIPPED TUNGSTEN CARBIDE SAWS
COMBINED DRILLS & COUNTERSINKS • CENTER REAMERS

Factory Mutual Laboratories, Norwood, Mass.

Factory Mutual Laboratories test

SHELL IRUS FLUID 902

the low-cost, fire-resistant hydraulic fluid

Factory Mutual Laboratories, the well-known industrial testing authority, recently evaluated Shell Irus* Fluid 902.

The tests performed included:

1. **Flash Point**
2. **Autoignition**
3. **Flame Propagation**

The Shell Industrial Engineer can give you more information about these tests.

*Trademark

In plant after plant, users find that Shell Irus Fluid 902 is comparable in fire resistance to much higher-priced hydraulic fluids.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

For more information fill in page number on Inquiry Card. on page 241

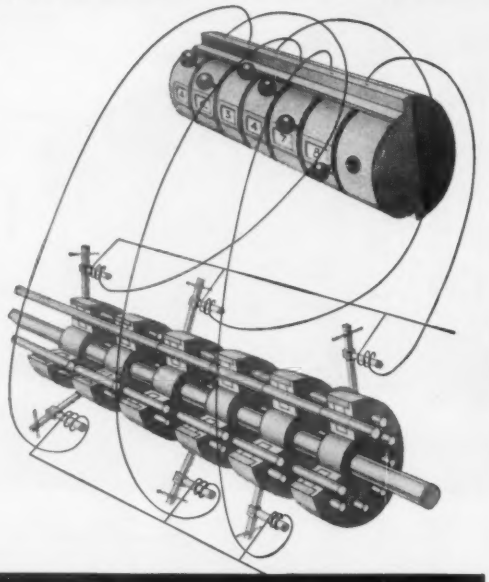
KBF2 BORING AND MILLING MACHINE

WITH AUTOMATIC SPINDLE POSITIONING CONTROLLED BY HAND POSITIONER OR PUNCHED CARD SYSTEM

Preselective automatic positioning anywhere within a 50" x 30" area.

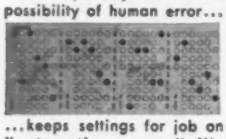
ELIMINATES JIGS & FIXTURES!

FOR SINGLE PIECES, SMALL OR LARGE BATCHES

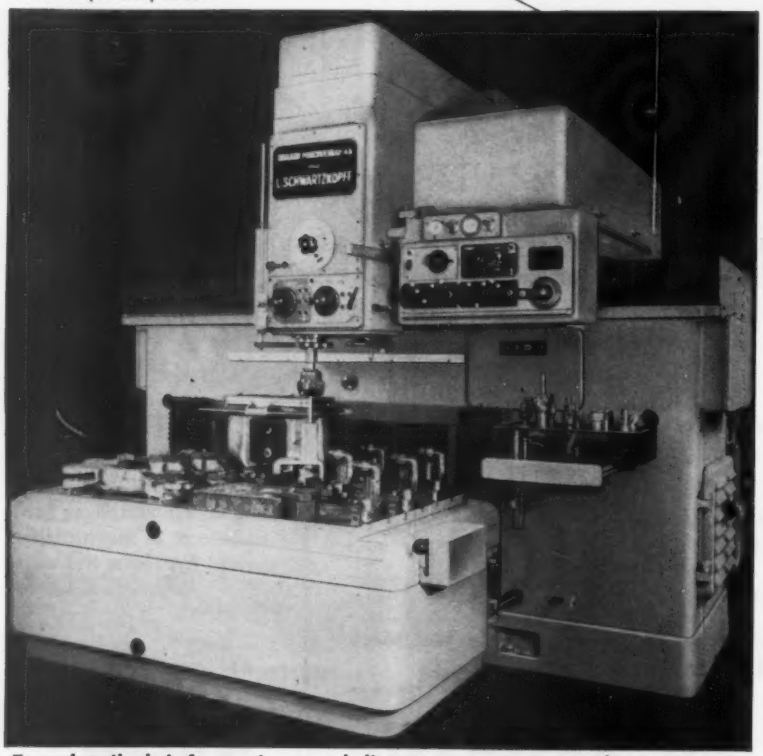


NEW!

Automatic Punch Card control completely eliminates possibility of human error...



...keeps settings for job on "automatic memory" file whenever job is repeated!



For detailed information and literature, contact sole importers:

MARAC MACHINERY CORP.

45 SO. BROADWAY, YONKERS, N. Y. • YOnkers 8-0500

ARBOR PRESSES—See Presses Arbor

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Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
South Bend Lathe Wks., South Bend 22, Ind.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

ARC WELDERS—See Welding Equipment, Arc

AUTOMATIC SCREW MACHINES—See Screw Machines, Single- and Multiple-Spindle Automatic

BABBITT

American Crucible Products Co., Lorain, Ohio
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALL-MAKING MACHINES

Haynes Stellite Co., Kokomo, Ind.
New Departure Div., Bristol, Conn.

BAR MACHINES—See Screw Machines, Single- and Multiple-Spindle, Automatic

BAR STOCK, Non-ferrous

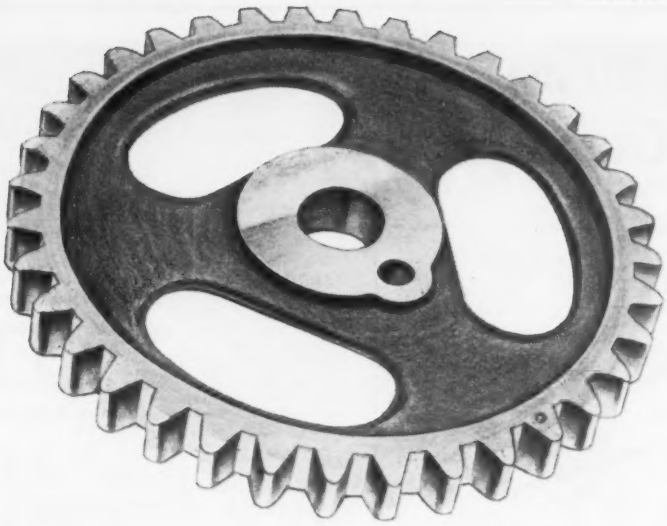
American Crucible Prod. Co., Port Huron, Mich.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Mueller Brass Co., Port Huron, Mich.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

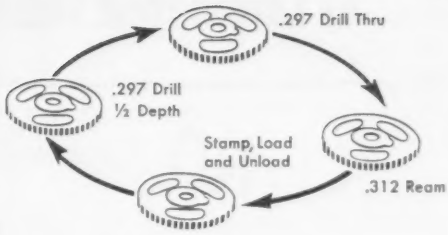
BAR STOCK AND SHAFTING, Steel

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.
Cumberland Steel Co., Cumberland, Md.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BEARING PILLOW BLOCKS AND CARTRIDGES

Fafnir Bearing Co., New Britain, Conn.



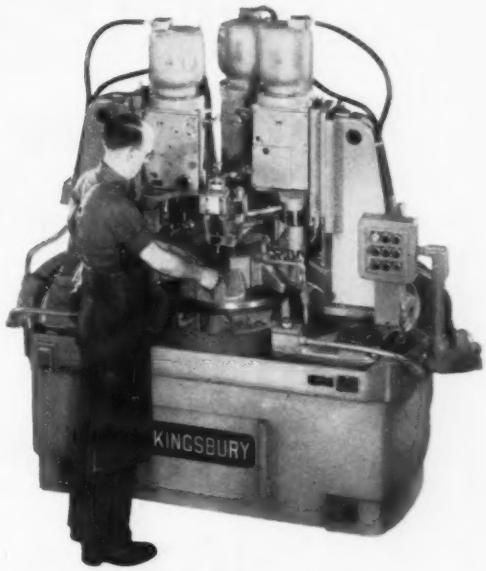


450 PER HOUR GROSS

- **DRILLED**
- **REAMED**
- **STAMPED**

— on this high production

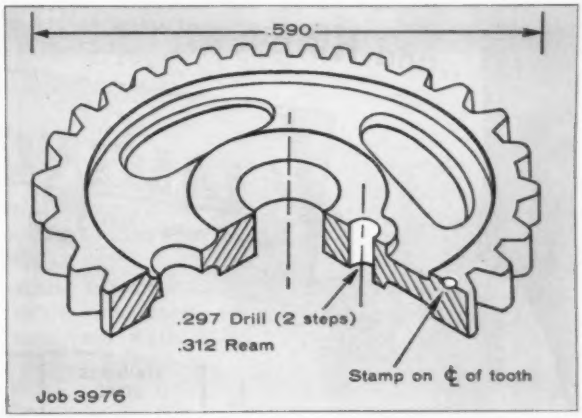
KINGSBURY



This 4-station Kingsbury has a 72" semi-circular base, 20" index table, JIC electrical controls (not shown)

This machine has three single-spindle vertical units, two for drilling and the third for reaming. Drilling in two steps shortens the time cycle, thereby increasing the hourly production. A special mechanism at the operator's station stamps the gear. The operator has only to load the work, push a button, unload completed work. All operations are done automatically at each station.

Kingsbury indexing automatics are built for jobs as simple as this one, to complex ones involving a dozen or more drilling, tapping and other operations. In every case, the customer gets a fully tooled machine, ready to produce at the rates he wants. If you have operations like these, we'd like to show you how economically they can be done on a Kingsbury. Kingsbury Machine Tool Corporation, Keene, N. H.



KINGSBURY
INDEXING AUTOMATICS
for high production drilling and tapping

For more information fill in page number on Inquiry Card, on page 241

MESSAGE from the "NO" men of Laminated Shim Company

You lose **NO** time when you use LAMINUM SHIMS...

NO machining!

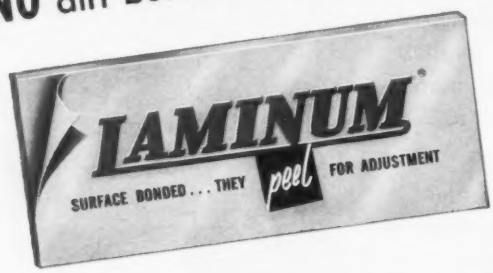
NO grinding!

NO counting!

NO stacking!

NO miking!

...and **NO** dirt between layers—ever!



Laminated Shims of **LAMINUM** now available in

STAINLESS STEEL with laminations of .002" or .003"	ALUMINUM with laminations of .003" only
BRASS with laminations of .002" or .003"	LOW CARBON STEEL with laminations of .002" or .003"

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Shim Headquarters since 1913

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Ball & Roller Bearing Co., Danbury, Conn.
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Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., Poughkeepsie, New York
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., Bristol, Conn.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy

American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

BEARINGS, Needle

Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Oilless

American Crucible Prod. Co., Lorain, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BEARINGS, Roller

Ball & Roller Bearing Co., Danbury, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust

Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BELT SANDERS—See Grinding Machines, Abrasive Belt

BELTING, Transmission

Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
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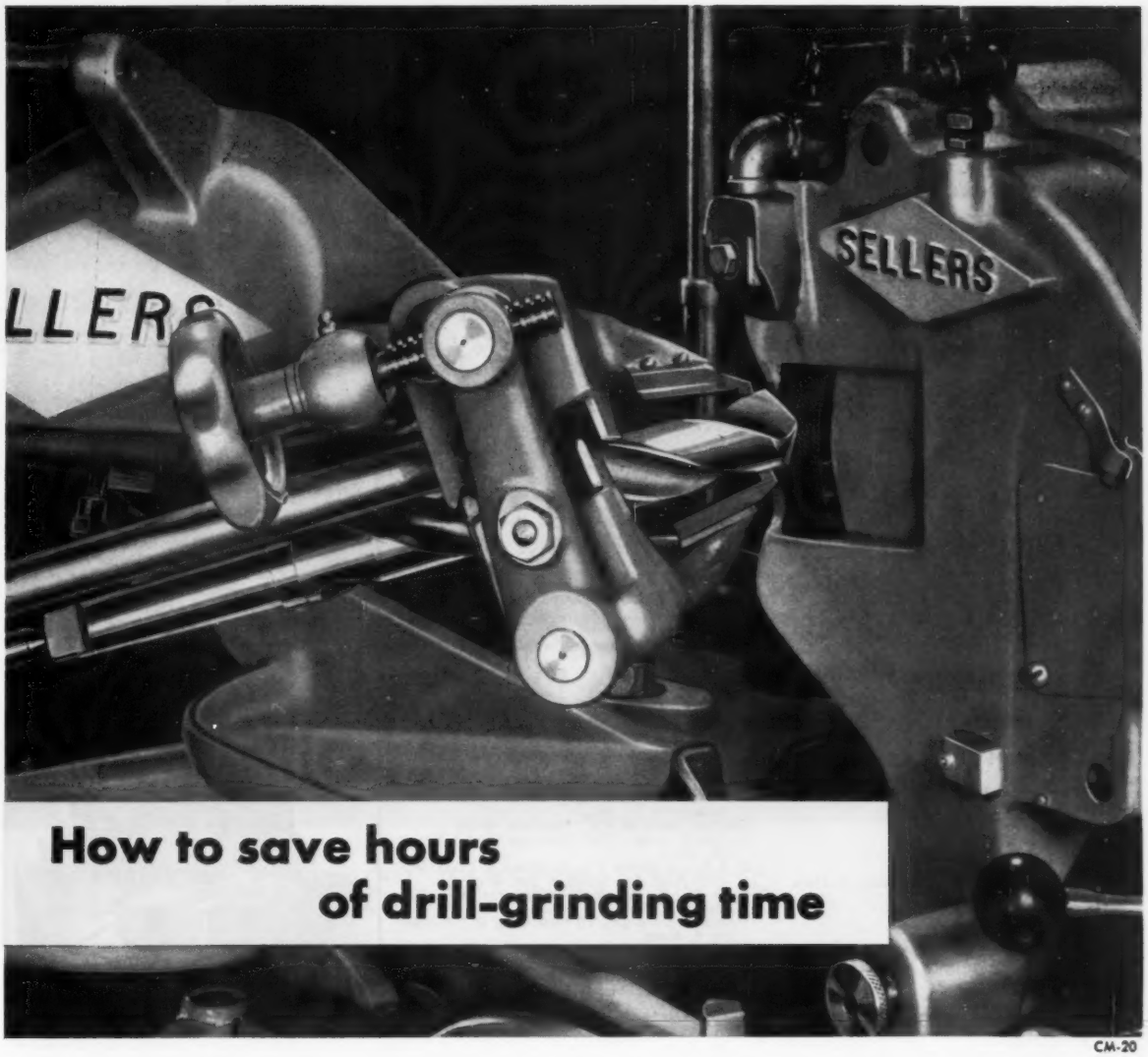
South Bend Lathe Works, South Bend 22, Ind.

BENDERS, Bar, Tube, Channel, etc.

Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.



How to save hours of drill-grinding time

CM-20

Minutes saved on each drill you grind soon add up to hours. That's why it will pay you to study your drill-grinding system and see how it can be speeded by using the Sellers machine.

The Sellers drill grinder is fast. A few seconds to chuck, a few passes across the point and the job's done. What's more, if you want to reclaim burned or broken drills you can remove the excess stock with a fast roughing operation followed by a finish grind. *The grinder is built for both rough and finish grinding.*

No skill is required to grind perfect drill points the Sellers way. Operation of the chuck is so easy and quick, and operation of the machine so simple, an *unskilled* operator can accurately grind more drills than an *experienced* hand grinder.

The Sellers machine is famous for saving valuable time—for eliminating tedious hand work and for speeding any drill grinding operation.

Ask for details. Send for a copy of Bulletin 4201.

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FARREL-BIRMINGHAM COMPANY, INC.
Rochester 10, New York
Plants: **Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.**

CONSOLIDATED ALSO BUILDS: Engine Lathes • Vertical Boring and Turning Mills • Floor and Planer-Type Horizontals • Planers, Double Housing and Openside • Planer-type Milling Machines • Plate Edge Planers • Vertical Slotters • Rotary and straight-line, Production-type Milling Machines • Skin Mills for Aircraft Manufacturing • Circular Cold Saws • Railroad Wheel and Axle Machinery • Special Machine Tools.

For more information fill in page number on Inquiry Card, on page 241

BENDERS, Plate, Etc.

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Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

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Chambersburg Engrg. Co., Chambersburg, Pa.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.
Watson-Stillman Co., Roselle, N. J.

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Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

BLAST CLEANING EQUIPMENT

Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
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BLOWERS

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Dykem Co., 2307 N. 11th St., St. Louis 6, Mo.

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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Ottemiller, W. H., & Co., York, Pa.
Parker-Kalon Div., Clifton, N. J.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

BOOKS, Technical

Industrial Press, 93 Worth St., New York 13, N. Y.

BORING BARS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metallurgical Products Dept. of General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING HEADS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.
Bridgeport Machines, Inc., 500 Lindley St., Bridgeport 6, Conn.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lovejoy Tool Co., Inc., Springfield, Vt.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

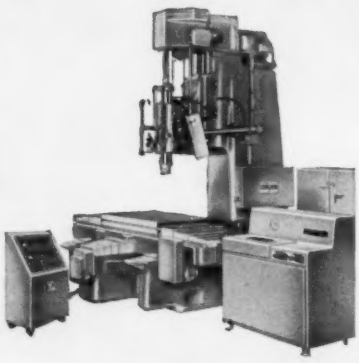
BORING MACHINES

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Bridgeport 6, Conn.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
DeVlieg Machine Co., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukana, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr. Detroit 34, Mich.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pope Machinery Co., Haverhill, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette St., Detroit 9, Mich.
Wodell Equipment Co., Clark, N. J.
Wales-Strippit Co., Akron, N. Y.

BORING MILLS, Horizontal

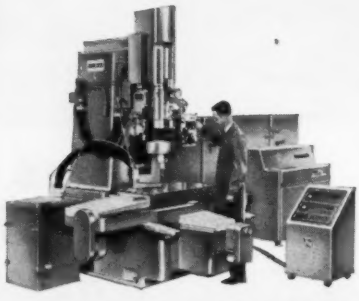
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Portage Machine Co., 1025 Sweltzer Ave., Akron 11, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

PRATT & WHITNEY NUMERICAL CONTROL APPLICATIONS



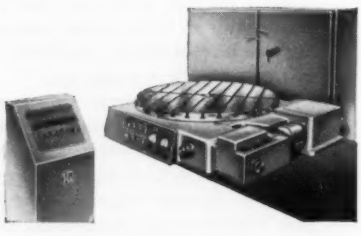
ELECTROLIMIT JIG BORER

Equipped with Numerical Control, the P&W No. 2E Jig Borer is equally suitable for toolroom and precision production applications. Settings accurate to .0001" are made automatically from data supplied by a punched tape or an operator's keyboard.



VERTICAL PRECISION HOLE GRINDER

Table and carriage are similar in design to the No. 2E Jig Borer and the same ultra-precision Electrolimit Measuring System is employed. Column, however, is equipped with interchangeable, turbine-driven grinding heads for spindle speeds to 100,000 rpm.



PRECISION ROTARY TABLES

These Pratt & Whitney Rotary Tables are the ultimate in precision and convenience for circular spacing, graduating and angular positioning. Settings accurate to 5 seconds of arc (2 seconds for repetitive settings) are made automatically from data supplied by punched tape or operator's keyboard.

PRATT & WHITNEY

TO "TENTHS" IN SECONDS

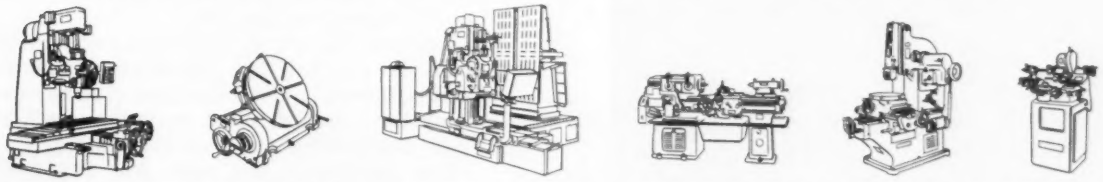
. . . *and no mistakes!*

WITH NEW PRATT & WHITNEY NUMERICAL CONTROL

Operating under Numerical Control, this P&W Precision Hole Grinder is positioned and re-positioned — accurate to .0001" — in an average of only 14 seconds! And since settings are controlled by a punched tape, the chance of work spoilage through operator error in reading blueprint data or setting dials is eliminated. The operator is free to concentrate his attention on work quality.

Applied to Pratt & Whitney Jig Borers, Precision Hole Grinders, Rotary Tables and special machines, Numerical Control not only speeds up toolroom operations, but also makes the high precision of these machines available for efficient short- or long-run production work. In this type work, time savings up to 40% over manual operation are realized. Compare the performance of your present manually-controlled machines with the new standards of speed, accuracy and economy being established by numerically-controlled P&W equipment. If they don't measure up, you are missing important opportunities for improved work quality, larger savings and greater profits.

Write now for complete information.
Pratt & Whitney Company, Incorporated,
12 Charter Oak Boulevard, West Hartford, Conn.



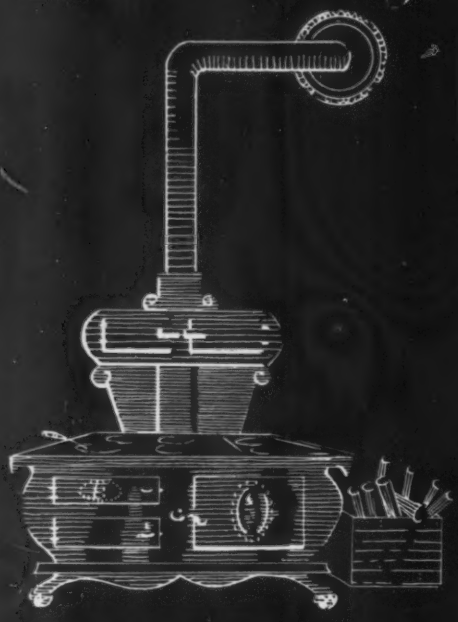
JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

PRATT & WHITNEY

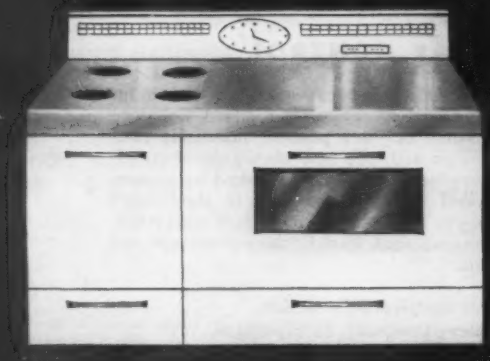
FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

Great in its day...



BUT WOULDN'T YOU
RATHER HAVE THE LATEST
TECHNICAL ADVANCE?



NOW
the latest technical
advance in tools...

"Job Tempered"

HAND and POWER

Hack Saws

Certified by American Standards Testing Bureau to meet their standards for superior cutting — Uniform Teeth... Uniform Set... Uniform Temper*

FROM Heller

Now you can cut all kinds of metal faster *and* cheaper... with hand or power hack saws... thanks to Heller's great new advance in tool technology — JOB TEMPERING.

Controlled-analysis steel is specially selected to strict Heller specifications, then Heller uses its own *unique* heat treating method to bring every blade to the precise hardness and temper to accomplish the class of work for which it is intended.

The result: JOB TEMPERED hand and power hack saw blades perform better and last longer on the toughest cutting jobs.

Based on this new development, every Heller blade is certified by American Standards Testing Bureau* to meet the three vital requirements for superior metal cutting — *Uniform Teeth, Uniform Set and Uniform Temper.*

You can choose the right JOB TEMPERED Blade from Heller's complete line. And if your sawing problem involves economy as well as the proper use of power hack saw blades, a HELOMETER will help prolong blade life, improve cutting and speed set-ups by showing you when blade tension is precisely correct.

Big Benefits in the Heller Line of "Job Tempered" Hack Saw Blades

GIVE US YOUR TOUGHEST HACK SAWING PROBLEMS

We'll show you how the *right* Heller JOB TEMPERED Blade can solve it efficiently and economically — delivering faster, smoother, trouble-free cutting over longer periods than ever before.

HERE ARE THE FACTS!

New Heller Hack Saw Catalog gives full information on sizes and types offered . . . shows why Heller JOB TEMPERED Blades, backed by the American Standards Testing Bureau*, are best in job performance.

WRITE FOR YOUR COPY TODAY.

*

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Heller "Job Tempered" Tools

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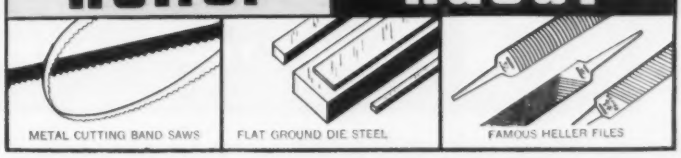
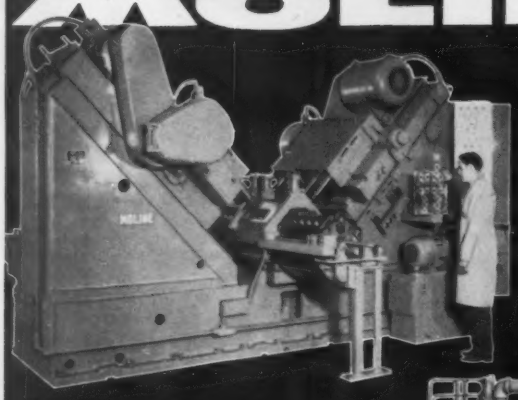
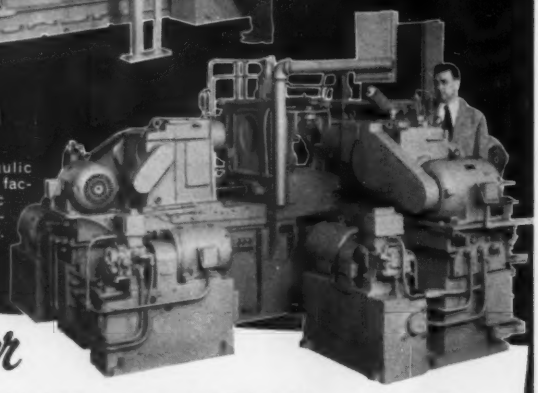


MOLINE



No. 13CB V-type cylinder boring unit is used either as an individual machine or as one of several automated units in a transfer line for boring automotive engine cylinders.



MR138 four-way, hydraulic feed, drilling, boring and facing machine with hydraulic clamping fixture for tractor main frame housings.

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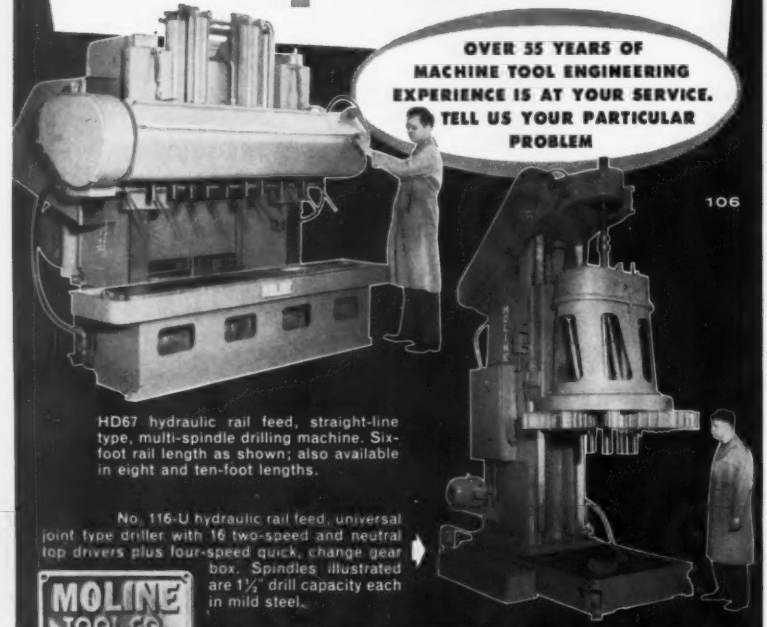

HD67 hydraulic rail feed, straight-line type, multi-spindle drilling machine. Six-foot rail length as shown; also available in eight and ten-foot lengths.

No. 116-U hydraulic rail feed, universal joint type driller with 16 two-speed and neutral top drivers plus four-speed quick change gear box. Spindles illustrated are 1½" drill capacity each in mild steel.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

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Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
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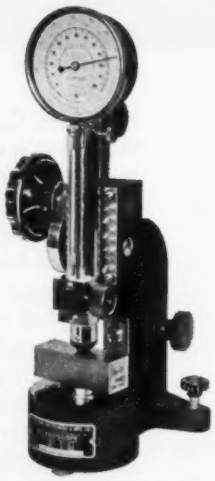

Standard Recording Scleroscope (right) with Clamping Stand, jaw capacity 3" high x 2½" deep. Supplied with following accessories: diamond hammer, hard and soft test block, V block for testing rounds, and steel carrying case.

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The Thompson 2F (8x10x24) Super Precision Grinder

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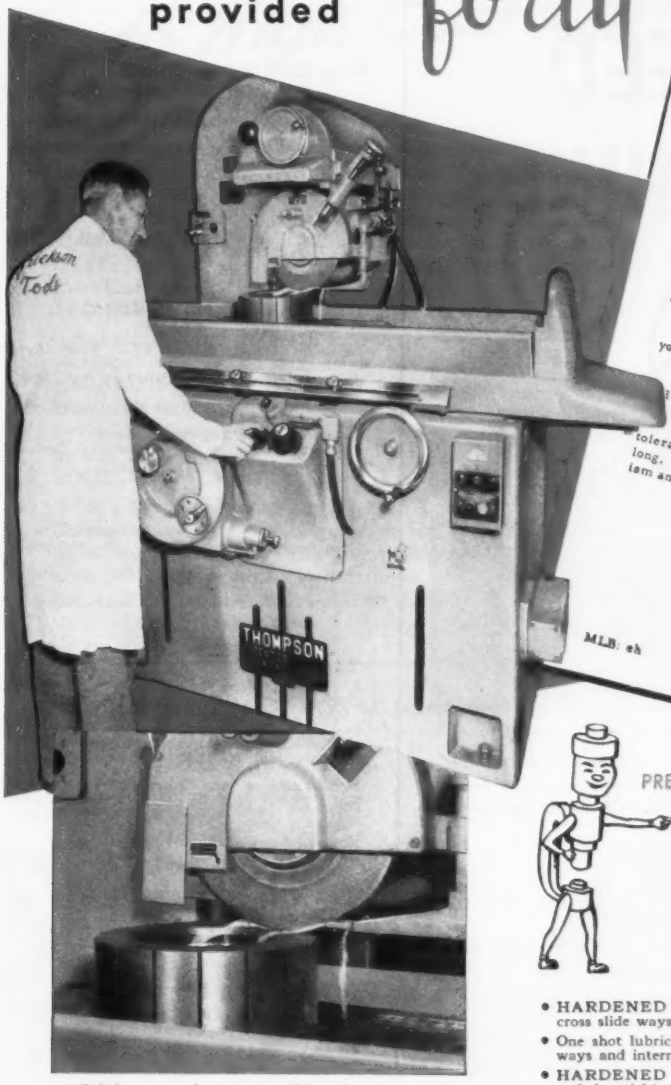

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We purchased this grinder on your claim of .0001 for parallelism size. This tolerance is necessary for most of our work.

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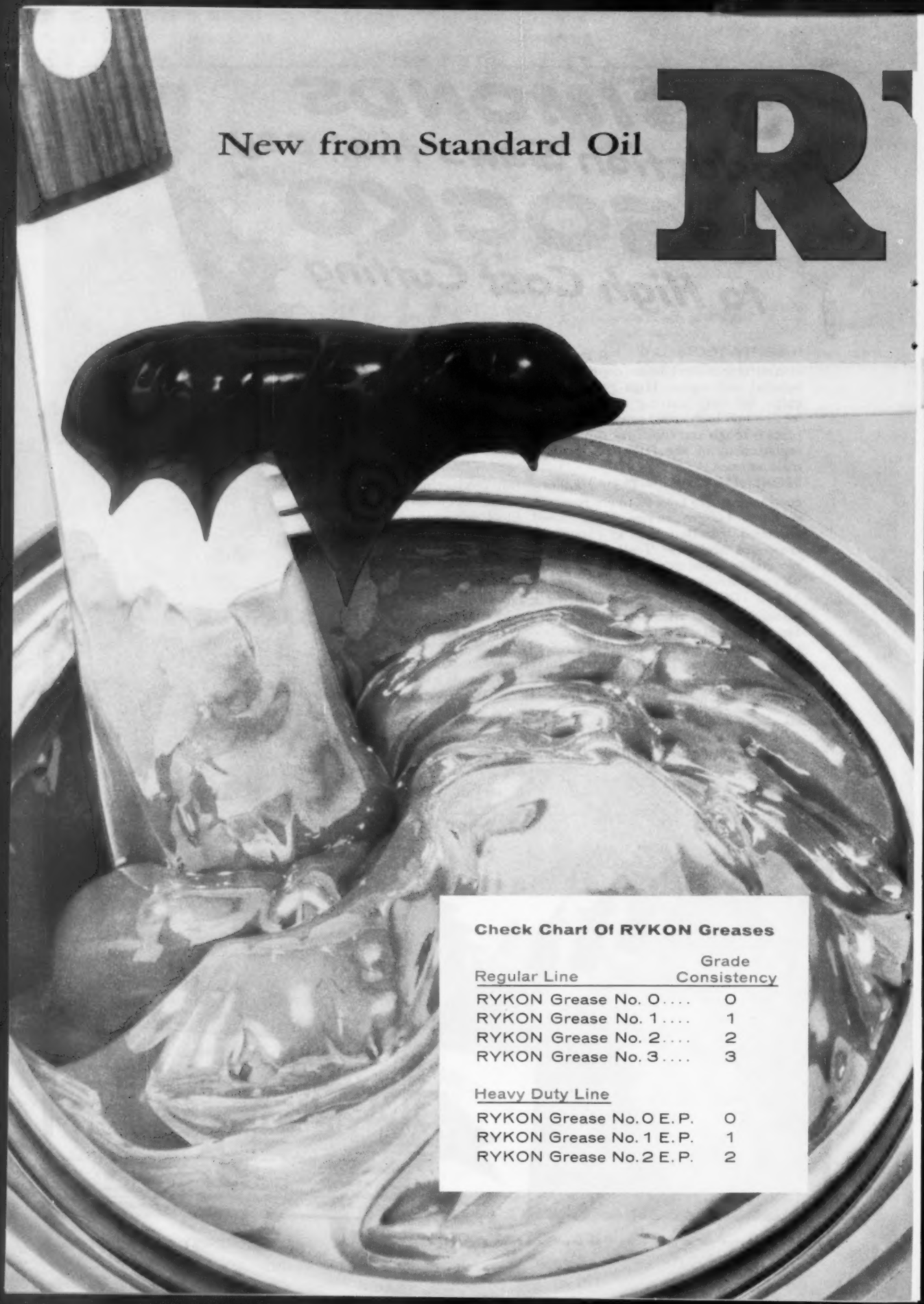

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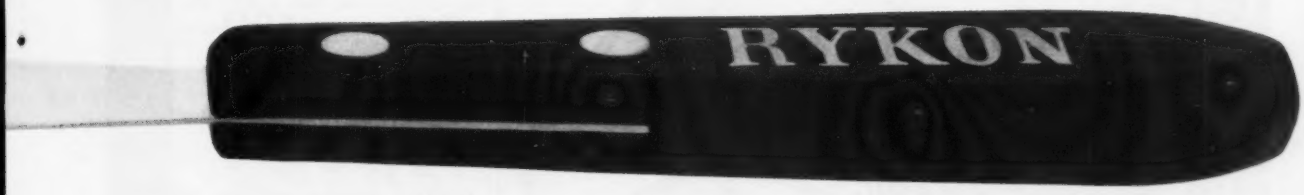
Regular Line	Grade Consistency
RYKON Grease No. 0	0
RYKON Grease No. 1	1
RYKON Grease No. 2	2
RYKON Grease No. 3	3
Heavy Duty Line	
RYKON Grease No. 0 E. P.	0
RYKON Grease No. 1 E. P.	1
RYKON Grease No. 2 E. P.	2

RYKON

GREASE



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RYKON Greases are multi-purpose. To meet specific grease lubrication problems, they are formulated in four regular and three heavy duty grades. There is a RYKON Grease to meet every lubrication problem.

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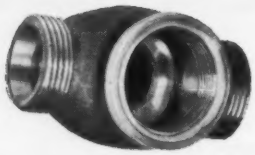

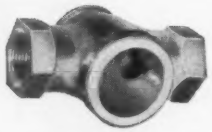

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Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Scully Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

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Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
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Cone Automatic Mch. Co., Inc., Windsor, Vt.
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Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
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(Continued on 293)

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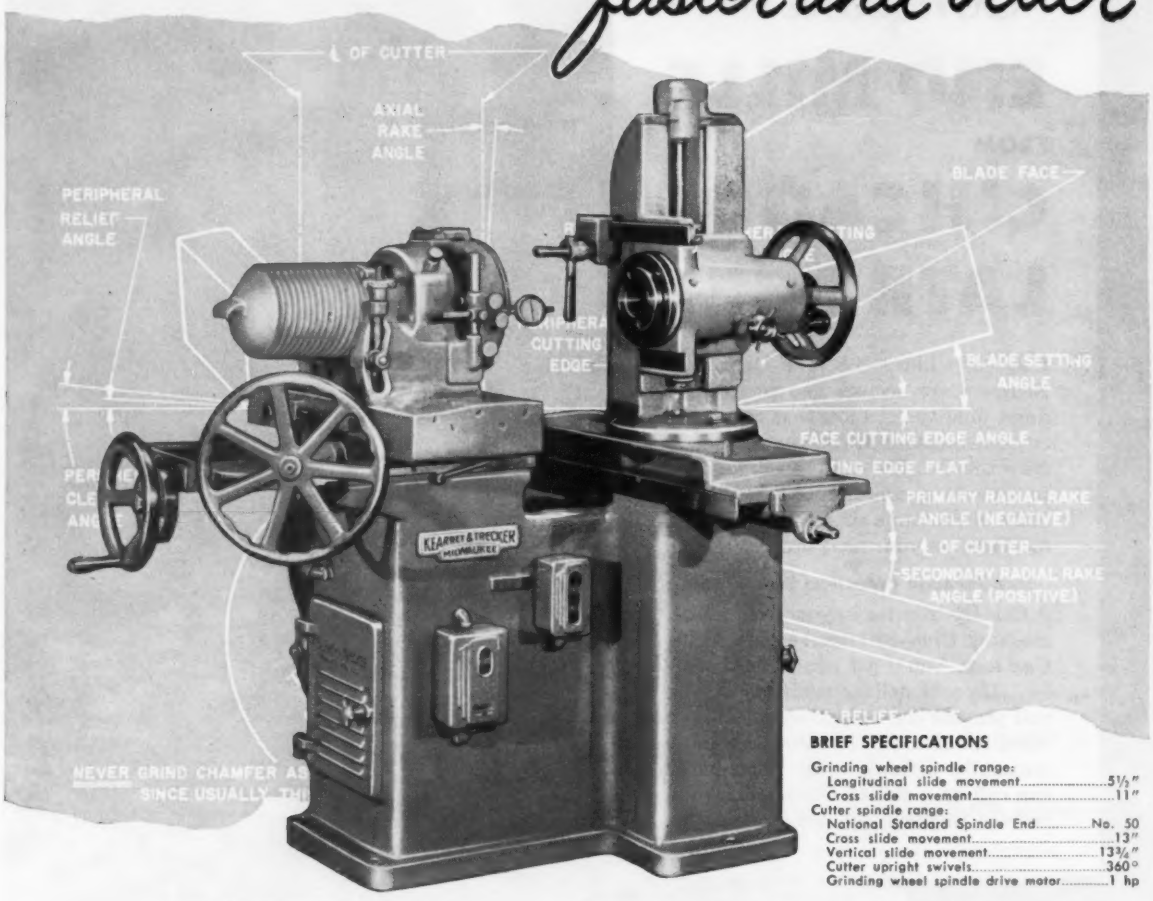

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Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Errington Mech. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
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Wadell Equip. Co., Terminal Ave., Clark, N. J.

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CHUCKS, Drill, Keyless

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa
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Homestrand, Inc., Larchmont, N. Y.
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Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Jacobs Mfg. Co., West Hartford, Conn.

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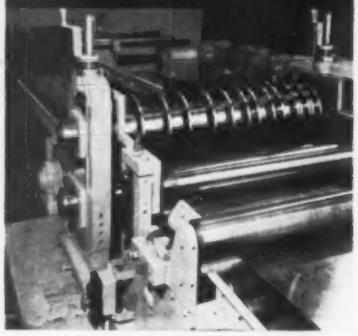
YODER SLITTING LINES



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In one plant, two Yoder tube mills and about 50 punch presses are being supplied with slit strands by one Yoder Slitting Line operated an average of only *seven hours per week.*

In another plant, a Yoder slitting line, *operated from six to eight hours per week,* is supplying two intermittently operated roll forming machines with total requirements averaging 100,000 feet per week.

These typical examples demonstrate, first, the big potential output of a relatively small, inexpensive Yoder standardized Slitting Line and, secondly, its big profitability. Assume production of only 35 tons of slit strands per 8 hour shift, one day per week, and the total per year would be 1750 tons. Estimating the saving in slitting cost at only one-half cent per lb., the total annual saving would be $17,500.00.

Besides the big convenience of doing your own slitting, such savings will often repay the investment in a few months.

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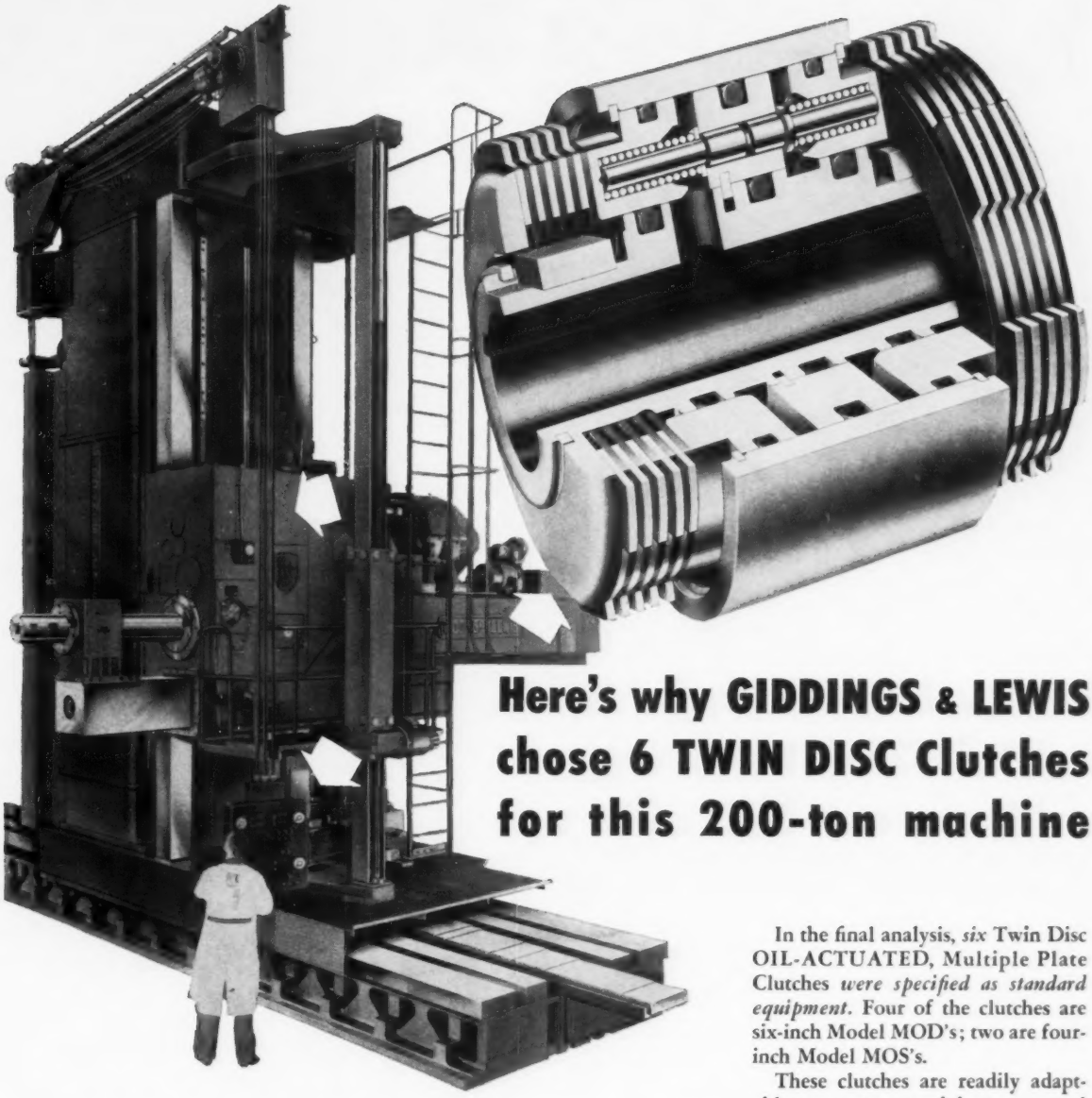
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Twin Disc Clutch Co., Racine, Wis.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.



Here's why GIDDINGS & LEWIS chose 6 TWIN DISC Clutches for this 200-ton machine

Arrows point to locations of four Twin Disc Model MOD Oil-Actuated Clutches and two Model MOS Oil-Actuated Clutches. These clutches provide more constant torque transmittal, longer wear life, elimination of adjustment, remote control at minimum cost and high capacity in a small package.

When Giddings & Lewis Machine Company designed its new Model 1210-FUAR—*the world's largest* Horizontal (floor-type), Boring, Drilling and Milling Machine with Underarm Support—*it was imperative that the right clutches were selected.*

This machine is 27 feet high, weighs over 200 tons—with a headstock that alone equals the weight of a 60-passenger airliner. Therefore specifications called for HIGH energy, HIGH inertia, HIGH capacity clutches.

In the final analysis, *six* Twin Disc OIL-ACTUATED, Multiple Plate Clutches *were specified as standard equipment.* Four of the clutches are six-inch Model MOD's; two are four-inch Model MOS's.

These clutches are readily adaptable to remote or push button control without complicated linkage. Since the floating or pressure plate forms the ram of the cylinder, ram travel increases automatically as plate stack wears. This eliminates adjustments to compensate for plate wear. Constant torque transmitting ability is thus provided during the entire life of clutch plates.

Find out *now* how Twin Disc Model MOD (duplex) or MOS (single) OIL-ACTUATED, Multiple Plate Clutches can be applied profitably to your machines. Request Bulletin No. 306.

TWIN DISC

TWIN DISC

Friction Clutches and Fluid Drives

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The Big Trend in Metalworking...

MOVE the metal ...it's cheaper than

HOW NEW METHODS SAVE BIG SUMS

A Parts are produced primarily by forcing metal into the desired shape rather than by "removing" or "machining" it. It is far faster... saves tremendously in time and labor.

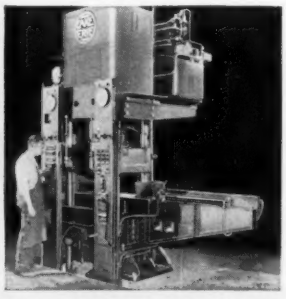
B The amount of metal in the initial slug, shot, billet, sheet, etc., is only slightly more than the total amount in the finished piece. Thus scrap and machining are held to an absolute minimum.

Metalworking plants casting about for ways to reduce production costs are turning more and more to the newer methods of forging, drawing and extruding in which metal is being "pushed around" rather than "removed." These processes basically are the hot extrusion of alloy steel, cold "pressure" forging of aluminum, cold extrusion of steel, and high pressure closed die extruding of aluminum and other non-ferrous alloys. Also falling within this category

Closed die extruding of heated aluminum reduced production time 99%.

Cold steel extrusion reduced scrap 43%.

Hot alloy steel extrusion is now an established art.



Metal powder parts are often produced with no machining.

- *New and improved production techniques save millions...arouse widespread interest*

1. Actual parts production is cut from hours in typical cases to minutes or even seconds.
2. Pieces generally have superior finish and improved physicals including grain structure.
3. Tolerances and uniformity equal or better those of older methods.
4. Scrap is greatly reduced and in many cases practically eliminated.
5. Unit costs go way down.

REMOVING it!

are somewhat older though greatly changed and improved methods for the extrusion of aluminum, hot forging of ferrous metals, powder metallurgy, deep drawing of sheet and die casting. The most recent developments involve variations and combinations of the above applied to many products and materials. Our engineers are in close daily contact with these developments. They'll be glad to help apply any of them to your production. Call or write us.

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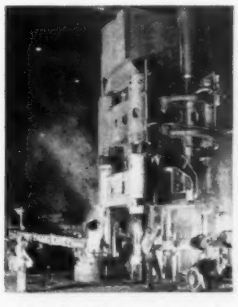
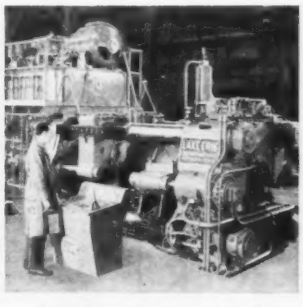
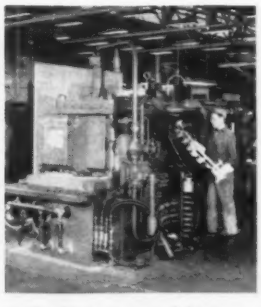


New developments in steel forging have greatly expanded its application.



Non-ferrous extrusion installations now embrace titanium, magnesium and newer metals.



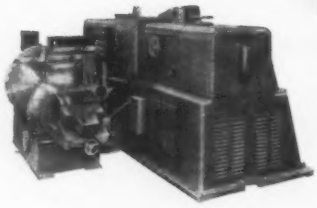
Production rates of die cast aluminum and zinc parts have been upped 20% to 30%

- *"MOVE the METAL" is NOT NEW...*

When this advertisement first appeared several years ago, it apparently sparked the current recognition of the "Move Metal" idea. Today the practice is widely accepted, acclaimed and growing. As the leader in the movement, Lake Erie will gladly share its experience with you.

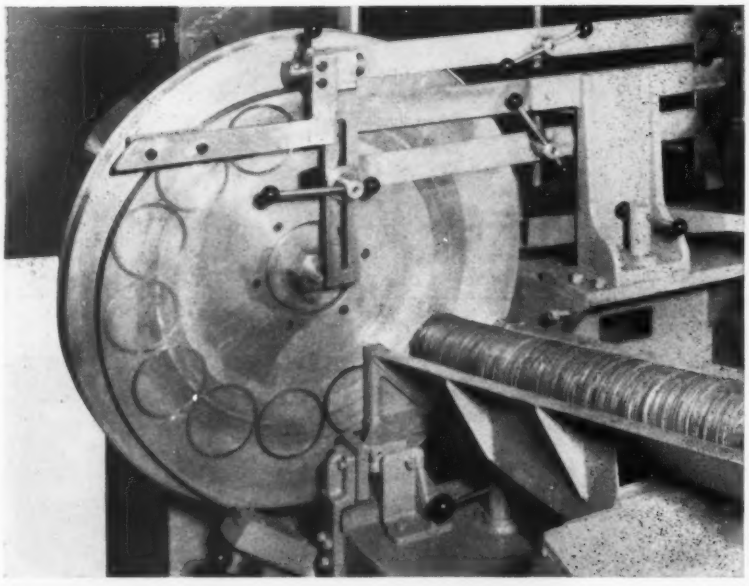
LAKE ERIE®

MAGNA-LOCK magnetic



ROTARY FEEDER

helps this disc grinder turn out six piston rings at each tick of the clock...

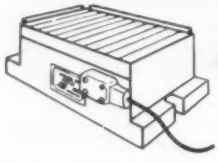


supplies continuous flow of pieces to the abrasive discs, permits full utilization of grinder's capacity

The Besly No. 240 Double Horizontal Spindle Grinder was developed to meet today's demands for ever increasing accuracy and speed. It's only natural that this machine incorporates automatic feeding—and only natural that a Magna-Lock electro-magnetic Rotary Feeder was selected.

Magna-Lock magnetic chucks and holding devices have solved many apparently unsolvable problems of holding, transferring and feeding. Perhaps Magna-Lock can solve *your* problem, too. Our engineers will be glad to work closely with you. Just write Dept. M-57.

Request Magna-Lock as original equipment on your new machines.



Hanchett MAGNA-LOCK CORPORATION
BIG RAPIDS, MICHIGAN, U. S. A.
designers and makers of a complete line of magnetic chucks and devices.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio

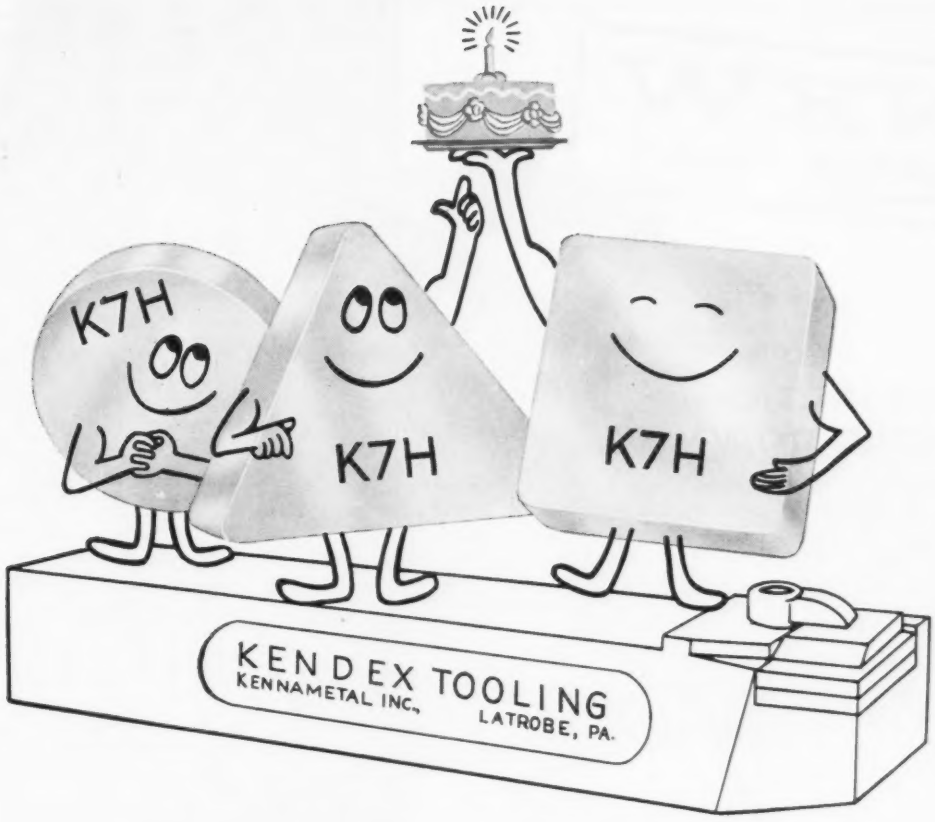
CUTTERS, Keyseating
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.
National Twist Drill Co., Rochester, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Barber-Colman Co., 1300 Rock St., Reckford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Goddard & Goddard Co., Detroit, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn. (dial, thread)
Haynes Stellite Co., Kokomo, Ind.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTING AND GRINDING FLUIDS
Cincinnati Milling Products Div., Cincinnati, Ohio
Cincinnati Milling and Girnding Mchs., Inc., Cincinnati 9, Ohio
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., Des Plaines, Ill.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES, Lathe Type
Bardons & Oliver, Inc., 1133 West Ninth St., Cleveland 13, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Pa.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.



KENNAMETAL* K7H

only a year old but already a champ

After only a year, Kennametal Grade K7H is the proven leader in high velocity machining and in cutting heat-treated and high tensile steels. Its high hardness (93.5 Rockwell A) combined with exceptional strength (three times that of the non-metallics) provides outstanding wear resistance and maximum resistance to cratering . . . high resistance to shock . . . fast cutting and excellent finish.

K7H "throw-away" inserts used with Kendex tooling are improving production and reducing tooling costs over a wide range of applications. Here are a few typical performances:

Production *increased 50%* by substituting K7H on an SAE 8620 forging with a finish cut .060″ deep, 900 sfm, and .018″ feed. K7H machined the same number of pieces per cutting edge as did a competitive carbide at a much slower speed.

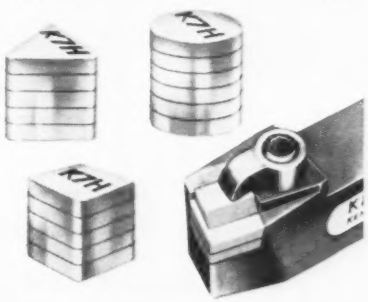
K7H cuts *252 pieces as compared to 30* . . . the best record for a competitive carbide in facing cut to dead center of SAE 1018 steel 5″ O.D. gear blank, at 1000 sfm (at outer edge) and .008″ depth of cut.

In a carbide evaluation test, the lineal footage cut by K7H was *five times* the best footage machined by any of three competitive grades tested . . . and with less than .005″ wear land. Material used: Halcomb 218 steel, 48 Rockwell C, .030″ depth at .010″ feed.

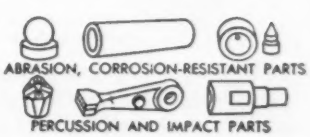
K7H *maintained excellent surface finish* . . . less than 10 microinch finish in cutting 4340 steel at 1000 sfm; 30 to 60 microinch finish in cutting 1095 steel at 1500 sfm.

Try K7H on your hard-to-machine materials and high velocity jobs. A Kennametal tool engineer can help you take advantage of this exceptionally strong Kennametal grade. Discuss your machining problems with him. Or write KENNAMETAL INC., Latrobe, Pennsylvania.

*Trademark C-3033



INDUSTRY AND **KENNAMETAL** ...Partners in Progress



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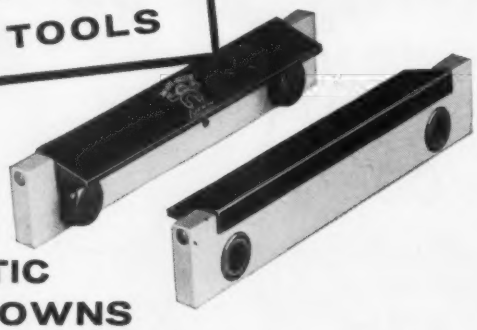
NEW LUFKIN TOOLS



MAGNETIC HOLD DOWNS

A new, time-saving idea in hold downs — faster, easier and more convenient. Attaches instantly and holds to vise jaws in any position without use of shims, blocks or parallels.

Clamping edge is 3/32", will hold very thin work. Backs are tapered, forcing the work downward as the vise jaws close. A flat spring tab keeps the hold down in a horizontal position until pressure is applied.

MAGNETIC BASE HEAVY DUTY Surface Gage

A large, rugged surface gage and indicator holder. Increased base size prevents rocking . . . larger, stronger magnets permit use with lug back and other heavy indicators and attachments.

The two heavy duty magnets recessed into the solid aluminum base are completely isolated from the spindle and other parts to avoid transmission of the magnetic pull. Polarity of the magnets is controlled by a king size on-off switch that turns the magnetic pull to full on . . . full off . . . or to any intermediate point to make minor adjustments in position. Ground and lapped, contact face has a V-groove, adapting it for use on cylindrical surfaces.

New design scriber has a removable, long-wearing carbide tip which can be reversed to protect the tip from damage when not in use.

Rugged, rocker arm and large diameter fine adjustment screw permit final, precise adjustments. 9" and 12" spindles, swivel indicator attachment, indicator holding rod, and scriber with reversible carbide tip are included. 18" spindle also available.

MITI-MITE MAGNETIC BASE TOOLS CATALOG

Send for this new 12 page illustrated catalog today. Contains full information on the complete Lufkin line of magnetic base tools.

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IT PAYS TO USE YOUR INDUSTRIAL DISTRIBUTOR
. . . He offers emergency 24 hour service

CUTTING TOOLS—See Tool Material

CYLINDERS, Air

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio
Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee Wis.
Vickers, Inc., Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

DEBURRING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio
Sheffield Corp., Box 893, Dayton 1, Ohio
Sunnen Products Co., 7910 Manchester, St. Louis 17, Mo.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge Mass.
Lufkin Rule Co., Saginaw, Mich.

DIE CASTINGS—See Casting, Die

DIE CASTING MACHINES

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo, N. Y.

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Dayton Rogers Mfg. Co., Minneapolis, Minn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Minster Mch. Co., Minster, Ohio
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIEING MACHINES

Pratt & Whitney Co., Inc., West Hartford, Conn.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Kennametal Inc., Latrobe, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

DIE SETS AND DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wales-Strippit Co., Akron, N. Y.

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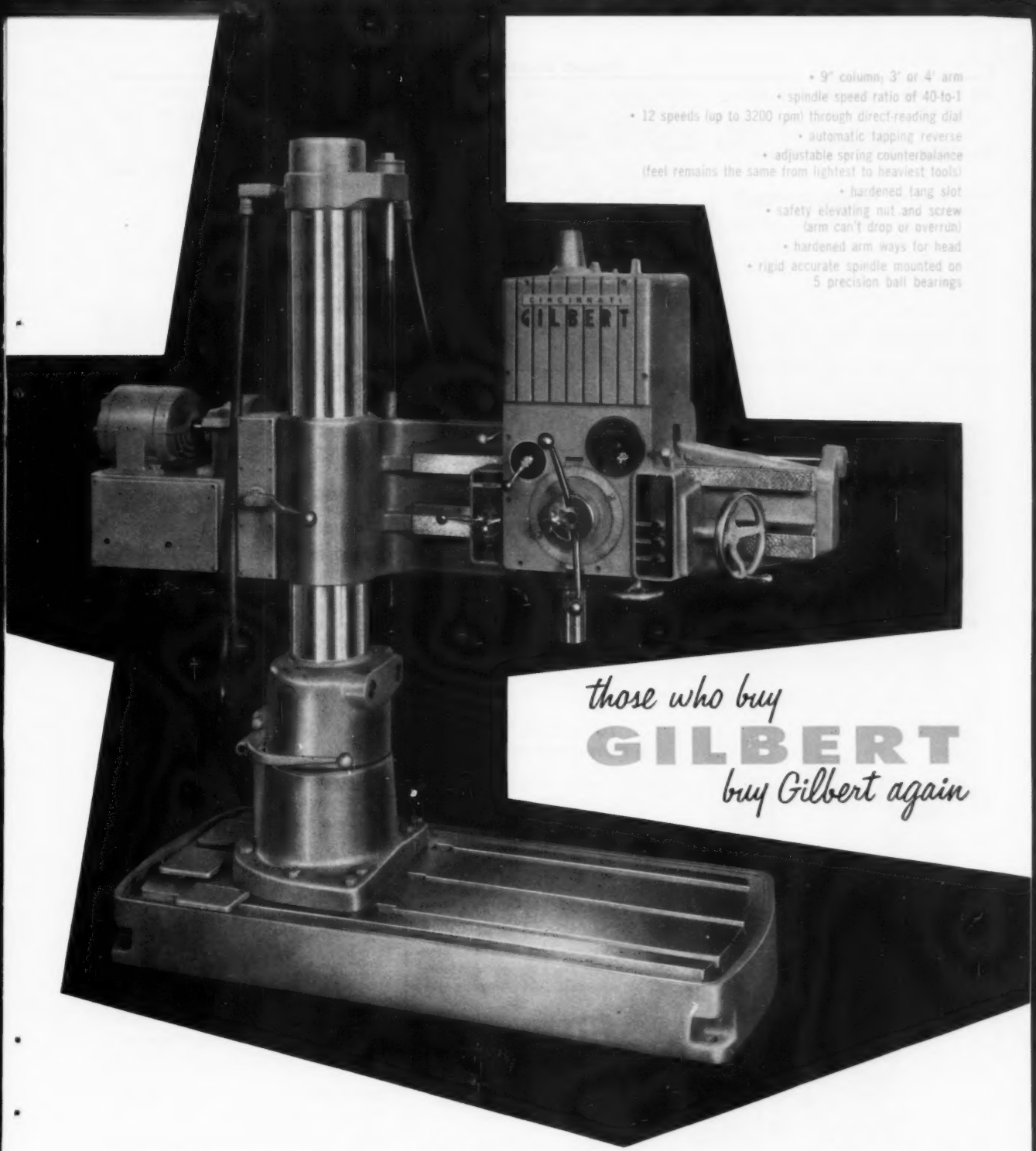

- 9" column, 3' or 4' arm
- spindle speed ratio of 40-to-1
- 12 speeds (up to 3200 rpm) through direct-reading dial
- automatic tapping reverse
- adjustable spring counterbalance (feel remains the same from lightest to heaviest tools)
- hardened tang slot
- safety elevating nut and screw (arm can't drop or overrun)
- hardened arm ways for head
- rigid accurate spindle mounted on 5 precision ball bearings

those who buy
GILBERT
buy Gilbert again

newest *high-speed* radial

Your many demands for a high-speed light-duty radial are met—completely and economically—by this new Gilbert 3 hp machine. Compare the features at the right with other radials of equal capacity, and you see why the Gilbert is the best buy in its class. Traditional Gilbert accuracy, fast response, and wide-angle work visibility make your shop more productive, more versatile. Variety of bases, runway mounting, or tables available. Get all the details in Bulletin 255.

The Cincinnati Gilbert Machine Tool Co.
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DIE STOCKS—See Stocks and Dies

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Cincinnati Shaper Co., Hopple & Garrard, Cincinnati, Ohio
Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Lettering and Embossing

Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Self-opening Threading

Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Eastern Mch. Screw Corp., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling

Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

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Elox Corp., Royal Oak 3, Mich.

DIVIDERS AND TRAMMELS—See Layout and Drafting Tools

DIVIDING HEADS—See Indexing and Spacing Equipment

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Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
DoAll Co., Des Plaines, Ill.
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAWING COMPOUNDS

Oakite Products, Inc., 26 Rector St., New York 6

DRESSERS, Grinding Wheel

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Colonial Broach & Machine Co., P. O. Box 37, Harper St., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hoglund Eng. & Mfg. Co., Inc., Berkeley Hts., N. J.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

DRIFT KEYS

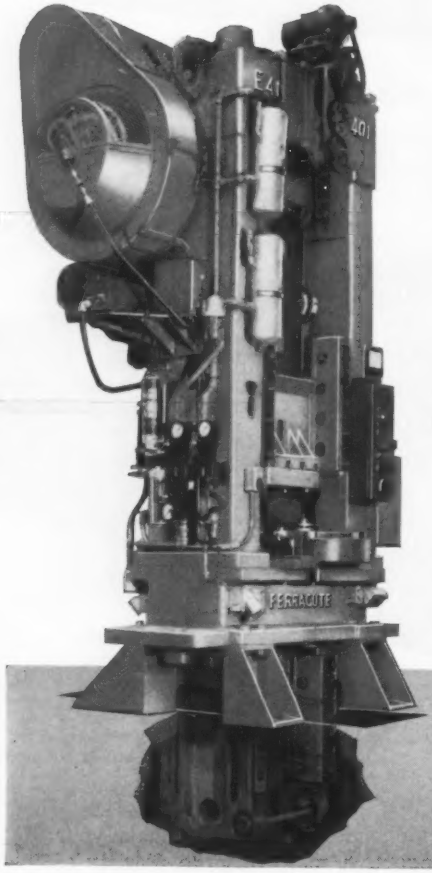
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
DoAll Co., Des Plaines, Ill.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buffalo Forge Co., Broadway, Buffalo, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.

(Continued on page 304)

A NEW FERRACUTE PRESS



TO SIZE OR "RESTRIKE" *POWDERED METAL* PARTS

400-ton SPECIAL DOUBLE TOGGLE COINING PRESS with 100-ton pressure on lower knockout

Stroke: Upper toggle—9"
Stroke: Lower knockout—1" to 3½"
Variable Speed Drive: 15 to 30 S.P.M.
Feeding Mechanism: Cam-operated dial

Your inquiries invited on the efficient press production of powdered metal components. Press sizes and tonnage capacities available to meet your requirements.

FERRACUTE

FERRACUTE MACHINE COMPANY
Builders of Power Presses and Special Machinery
Bridgeton, New Jersey, U.S.A.

Don Oberg tells why the Moore Jig Grinder is an absolute must in any good die shop

by **DON E. OBERG**
General Manager
Oberg Manufacturing Co., Inc.
Tarentum, Pa.
Largest Manufacturer of
Carbide Dies

"One of the most important features of an Oberg-built die is guaranteed complete and positive interchangeability of parts throughout the life of the die. *This feature would be practically impossible without the application of Moore Jig Grinders.*

"With Moore Jig Grinders we can accurately locate holes with relation to each other as well as size holes to extreme accuracies. We can efficiently grind contours on carbide die sections which would be impractical by almost any other method. Back taper on contoured carbide die sections and piercing holes can be readily generated on Moore Jig Grinders.

"We feel it would be *practically impossible* to produce the high precision carbide dies required by industry today without the Moore Jig Grinder. *In our opinion it is an absolute must in any better-than-average die shop.*"

As Mr. Oberg points out, the Moore Jig Grinder has no equal on many essential toolroom operations. If you would like a bulletin describing some of the features that make this machine so outstanding, just drop us a line.

MOORE SPECIAL TOOL COMPANY, INC.
734 Union Avenue, Bridgeport 7, Connecticut

"The things we like best about our four Moore Jig Grinders are the sturdiness and dependable long-life accuracy built into them. Ours are used ten hours or more every day. Even with this high activity, we have found no apparent inaccuracies from our oldest to our newest machine."

HOLES, CONTOURS AND SURFACES, Moore's authoritative book, tells how to produce tools, dies and precision parts *the modern way*. 424 pages, 495 illustrations. $5 in U. S. A., $6 elsewhere.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

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Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6403 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kiswaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Illinois

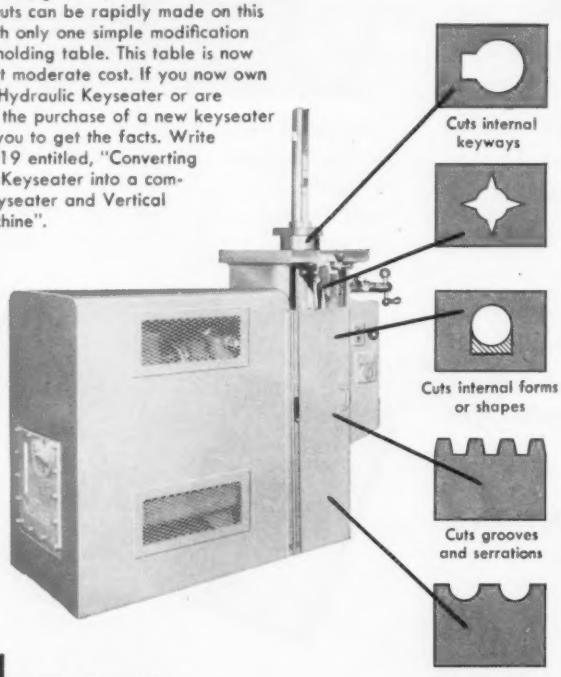
DRILL SLEEVES AND EXTENSION HOLDERS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio

TRIPLE THE USEFULNESS
OF YOUR M&M
KEYSEATER AND VERTICAL CUTTING MACHINE

Simple modification greatly increases productive capacity of this versatile machine.

An M & M Hydraulic Keyseater is not only a keyseater that cuts internal keyways up to 5" wide but a vertical cutting machine as well. Serrations, grooves, teeth—a wide variety of cuts can be rapidly made on this machine with only one simple modification — a work-holding table. This table is now available at moderate cost. If you now own an M & M Hydraulic Keyseater or are considering the purchase of a new keyseater it will pay you to get the facts. Write for Bulletin 19 entitled, "Converting the M & M Keyseater into a combination Keyseater and Vertical Cutting Machine".



M&M KEYSEATERS
AND VERTICAL CUTTING MACHINES

98

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DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Automatic Tool Co., Richmond, Ind.
National Twist & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.

DRILLING AND BORING UNITS, Self-contained

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Govro-Nelson Co., 1931 Antoinette St., Detroit 8, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Homestrand, Inc., Larchmont, N. Y.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., Milwaukee 14, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Western Machine Tool Works, Holland, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Automatic

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Edlund Mchry. Co. Div., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., Moline, Ill.
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olofsson Corp., Lansing, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Snow Manufacturing Co., Bellwood, Ill.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippit Corp., Akron, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Bench

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co. 2,5 East Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

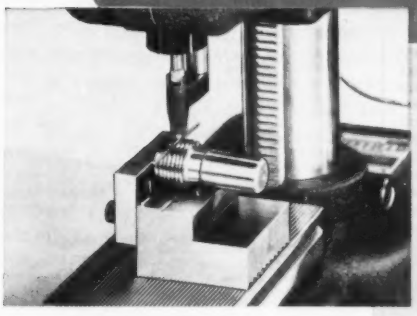
(Continued on page 306)

D Product Directory

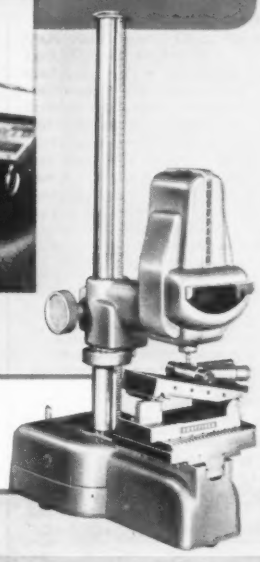
Use a SHEFFIELD VISUAL GAGE FOR 10 DAYS ... FREE

The Visual Gage being used to check O.D.

The Visual Gage in the toolroom.



Measuring the pitch diameter of tapered threads.



Using the sine bar fixture to check taper.

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See how simple it is—how fast—how sensitive—how positive—how rugged—and how easy to read.

See how many ways you can apply it to the precision work you are doing in the toolroom and in the shop.

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Dept._____ Position_____

Company_____

St. Address_____

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Delta Power Tool Div., 400 N. Lexington Ave., Pittsbugh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Henry & Wright Div., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Deep Hole

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippit Corp., Akron, N. Y.

DRILLING MACHINES, Gang, Multiple-spindle

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Henry & Wright Div., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., Box 989, Worcester, Mass.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., Moline, Ill.
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, South Bend 22, Ind.
Western Machine Tool Works, Holland, Mich

DRILLING MACHINES, Radial

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Carlton Mch. Tool Co., 2961 Meeker St., Cincinnati 25, Ohio
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLING MACHINES, Sensitive

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool Mfg. Co., Inc., Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Henry & Wright Div., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.
Levin & Son, Inc., Louis, 3610 So. Broadway, Los Angeles, Calif.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippit Corp., Akron, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLING MACHINES, Universal Radial

Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.

DRILLING MACHINES, Upright

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York, 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.

(Continued on page 308)

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for the size Lathes You Need Most

Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13". . . in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.

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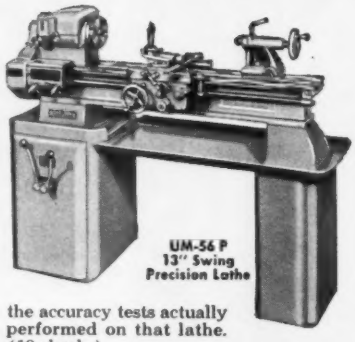

UM-56 P
13" Swing
Precision Lathe

the accuracy tests actually performed on that lathe. (19 checks).

Important optional features include: hardened bed ways, L00 Long Taper Key Drive spindles, 4" D1 Camlock spindles, bed turrets, taper attachments and a complete line of toolroom and production accessories.

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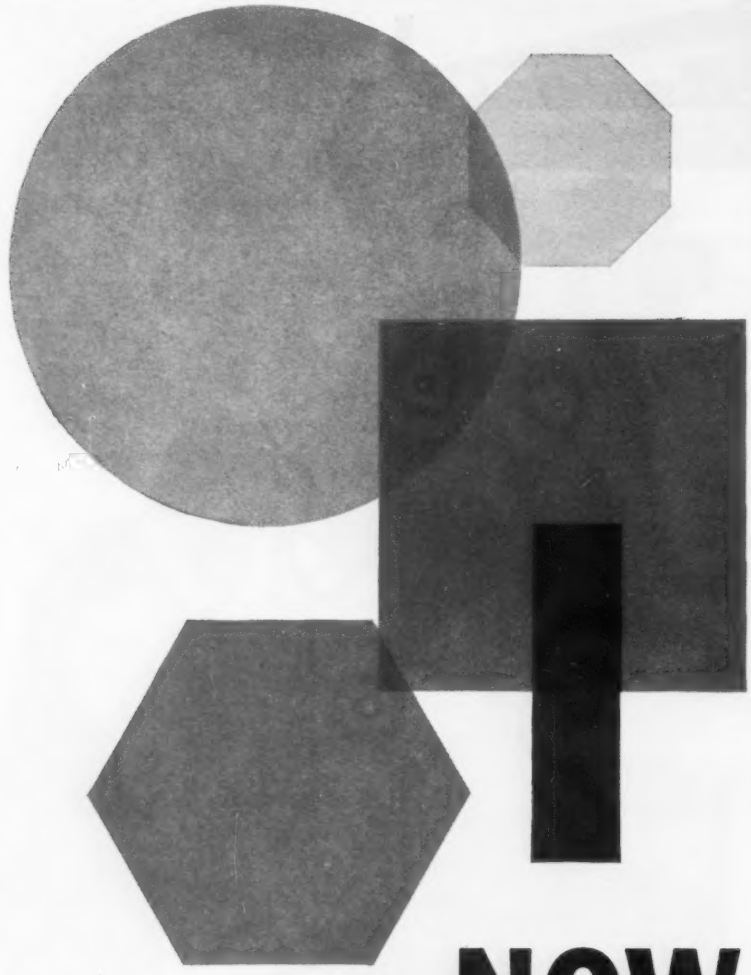

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National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., Akron, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLS, Center

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Deep Hole, Gun

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Star Cutter Co., Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Oil Hole, Oil Tube

Besly-Welles Corp., 112 Dearborn Ave., South Beloit, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
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DRILLS, Portable Pneumatic

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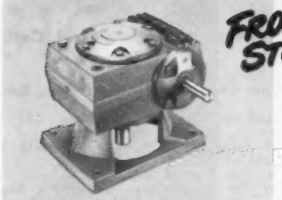

Vertical Right
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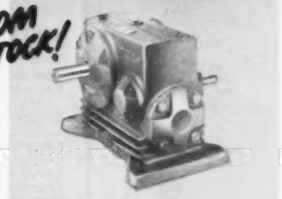

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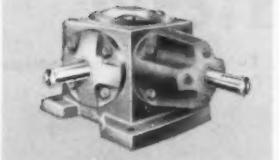
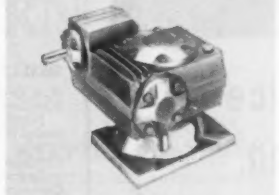
Horizontal Parallel Drive

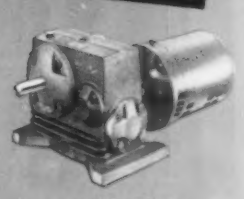


Horizontal Right
Angle Drive



Double Reduction
Vertical Right Angle Drive

Horizontal Right
Angle Drive



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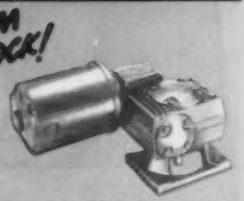

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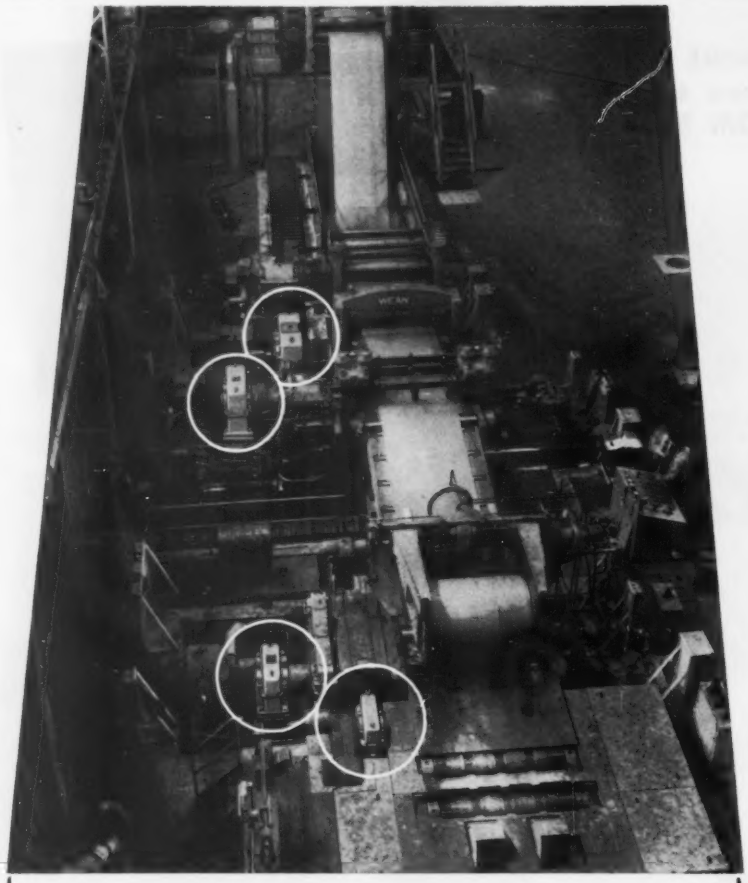

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Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Subland

Ace Drill Corp. Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., South Beloit, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist, High-Speed Steel, Carbon Steel

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist, Carbide, Carbide-tipped

Ace Drill Corp., Adrian, Mich.
Allegheny Ludlium Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

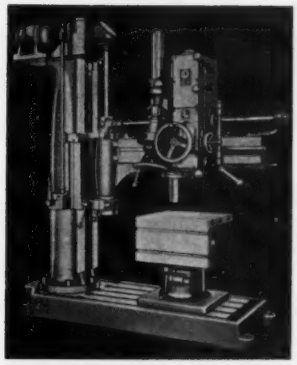
DRILLS, Wire

Ace Drill Corp., Adrian, Michigan
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATING ATTACHMENTS — See Tracing Attachments

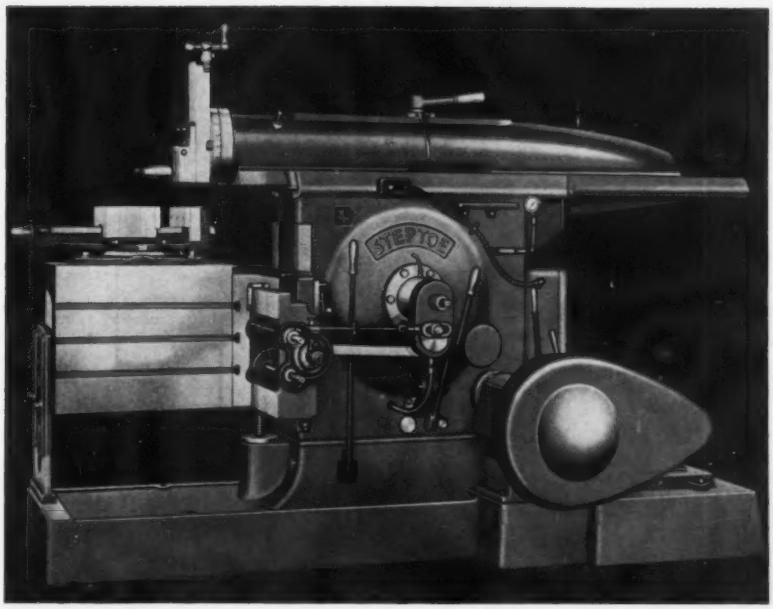
DUST COLLECTORS AND CONTROL SYSTEMS

Brown & Sharpe Mfg. Co., Providence, R. I.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio



WESTERN RADIAL DRILLS—Heavy Duty, 3 to 8 ft., 16 or 32 speeds. High Speed, 3 to 6 ft., 6, 9, 12 or 18 speeds.

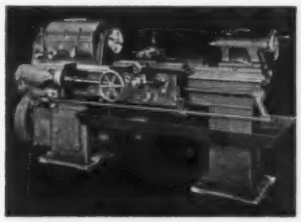
THE BIG 4 WESTERN LINE



"RELIABLE—SINCE 1895"

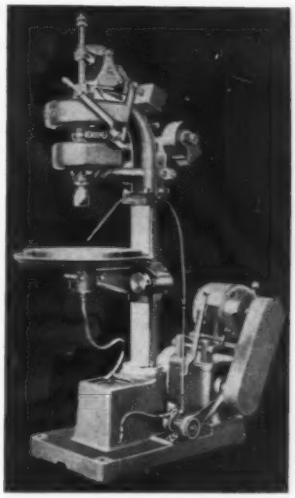
STEPTOE SHAPERS—Heavy Duty — 4 or 8 speeds — Timken bearing equipped—14", 16", 20" and 24" sizes.

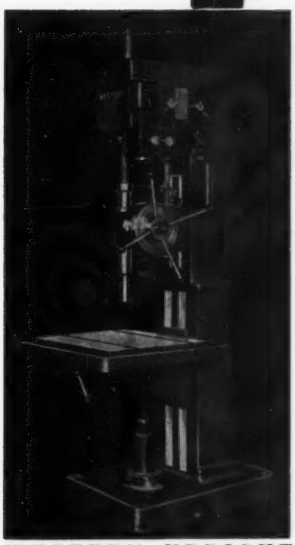
STEPTOE-WESTERN SHAPERS — Medium duty—4, 9 or 18 speeds up to 200 strokes per minute—12" and 15" sizes.



CHARD LATHES — Quick change, geared head; 16", 18" and 20" swing, 8 or 12 speeds.

GARVIN AUTOMATIC TAPPERS—Up to 3" pipe tap capacity; four spindle speeds.





WESTERN UPRIGHT DRILLS—Single or multiple spindle; 18 speeds; 9 feeds; all geared; up to 2½" capacity.

STEPTOE HEAVY DUTY SHAPERS have proven, accurate features, with a simplicity of component parts and absence of gadget attachments, and therefore have a very low maintenance cost and long life. All drive shafts, and the bull gear, are mounted on Timken bearings within dust-proof housings, and are supplied with an automatic forced feed lubricating system when so ordered. All gears within the speed box are of alloy steel, generated on Fellows Shapers, and chamfered where required for easy sliding engagement. Four speed changes within the speed box, combined with sliding back gears within the column, produce eight ram speeds in progression. All speed changes may be made while the machine is running, without clashing of different gear ratios. Also available in 12" & 15" High Speed, medium duty type, up to 200 strokes per minute—Full line of accessories.

For more information on these and other machines in the Big 4 line write for catalogs.

MANUFACTURED BY

WESTERN MACHINE TOOL WORKS

HOLLAND, MICHIGAN, U.S.A.

For more information fill in page number on Inquiry Card, on page 241

ELECTRICAL DISCHARGE MACHINES
—See Disintegrators

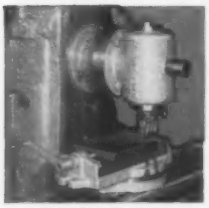
ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

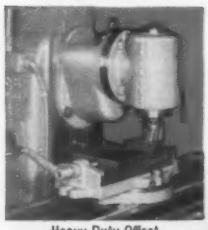
EXPANDERS, Mechanical, Hydraulic
Grotnes Machine Wks., Inc., 5454 N. Walcott, Chicago 40, Illinois

EXTRACTORS, Screw
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
Walton Co., Hartford 10, Conn.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

FACING HEADS
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis Boring Tool Div. Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.


Heavy Duty Vertical Milling Attachment


Heavy Duty Offset Vertical Milling Attachment

Universal Milling Attachment

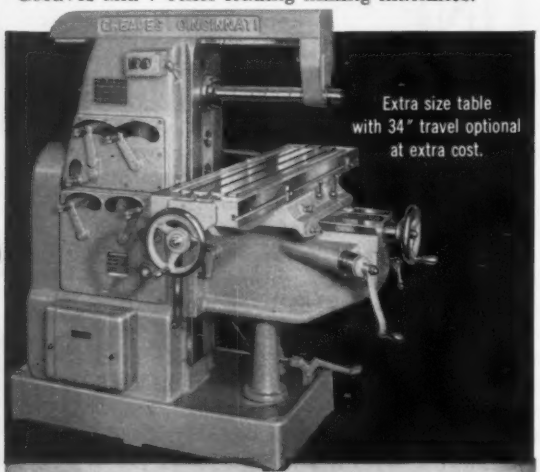
Toolmakers Overarm

Heavy duty attachments increase versatility of dependable, low-cost

GREAVES MILLS

"THE MOST MILL FOR THE LEAST MONEY"

A full line of attachments and accessories offer outstanding flexibility for all types of milling operations . . . with GREAVES MILLS. Make your own comparison of 22 specifications of Greaves and 7 other leading milling machines.



GREAVES MACHINE TOOL CO.
2500 Eastern Avenue, Cincinnati 2, Ohio

Send Comparison Chart. I will make my own comparison of GREAVES MILLS with other makes.
Send information on Attachments and Accessories for GREAVES MILLS.

NAME _____ TITLE _____
FIRM _____
ADDRESS _____
CITY _____ ZONE ____ STATE _____

FEEDERS, Automatic
Perry Equipment & Eng. Co., Erie, Penna.
Production Feeder Corp., Mentor, Ohio
V & O Press Co., Hudson, New York

FILES, Band
DoALL Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES AND BURRS, Rotary
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Severance Tool Ind., Inc., Saginaw, Mich.
Simonds Saw & Steel Co., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES
Chicago Pneumatic Tool Co., New York 17, N. Y.
DoALL Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Commercial Filters Corp., Lebanon, Ind.
Industrial Filtration Co., 15 Industrial Ave., Lebanon, Ind.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

FINISHES, Machine and Metal
Lowe Bros. Co., Dayton, Ohio

FLAME-HARDENING MACHINES
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

FORGING HAMMERS, Steam and Air
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

FORGING, Machines, Headers, Upsetters
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

FORGINGS, Drop
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow-Bored
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron, Mich.

FORGINGS, Press
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron, Mich.

(Continued on page 314)

. . . Fluid Power news

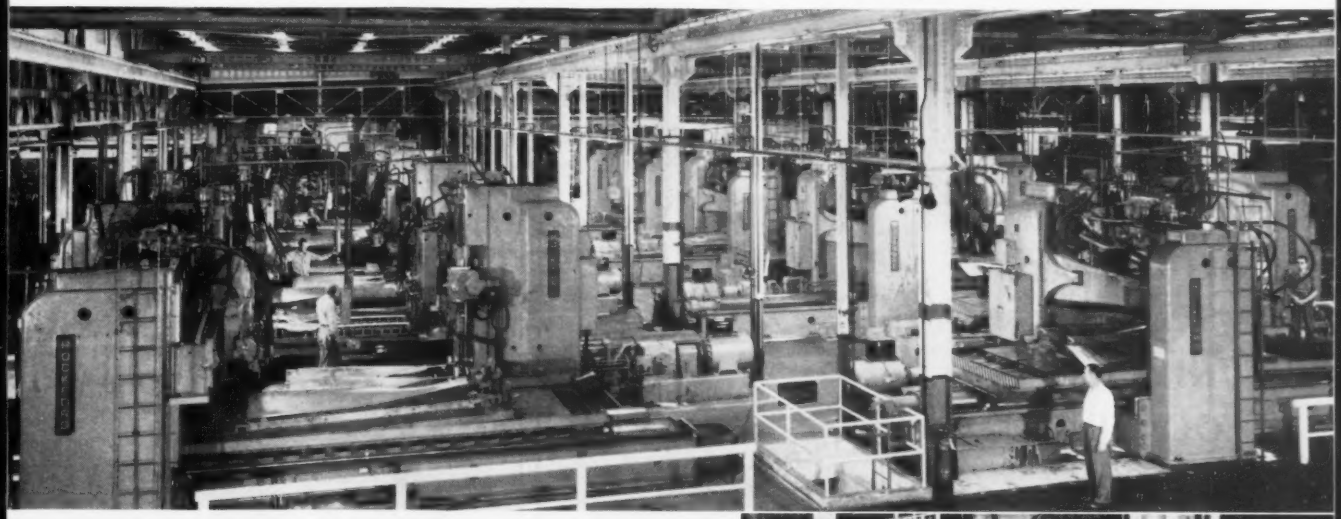
REPORT NO. 11,600 AID TO MACHINE DESIGN PROGRESS

From Oilgear Application-Engineering Files

HOW OILGEAR ENGINEERING TEAMWORK AIDS MACHINE DESIGN PROGRESS

CUSTOMER: Rockford Machine Tool Company

DATA: Application of Fluid Power system to planers that mass-duplicate the airfoil on new, solid, forged steel propeller blades. Six years has been spent on the development and manufacturing methods to produce this new blade. Planers to be equipped with tracer attachments to machine blades from master templates. Desired profile is completely machined to proper thickness . . . maintaining accurate airfoil on both sides of blade. Requirements: extreme accuracy; flexibility of control; elimination of shock, vibration and gear marks on work; independent, fast cutting and return speeds to keep costs to a minimum.



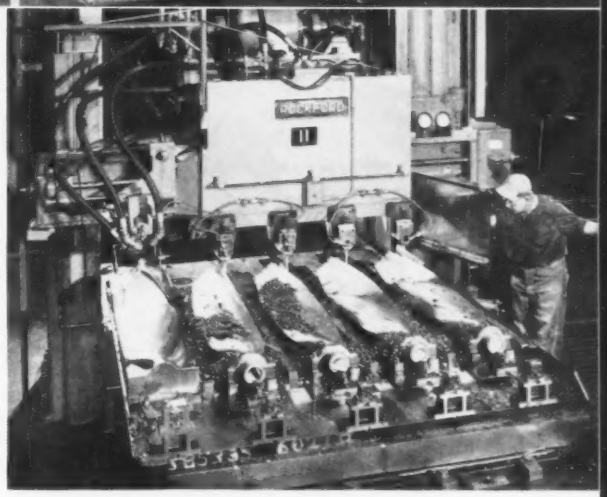
SOLUTION: Shown above are 20 Oilgear-equipped, Rockford Hy-Draulic planers machining aircraft propeller blades. Closeup (right) shows how Rockford's hydraulically operated "Kopy-Kats" can mass-duplicate four of these new-type, steel blades simultaneously from master templates. Rockford Machine Tool says of this set up, "The inherent advantages of hydraulic drive and control make this gigantic installation an extremely powerful production unit. Hydraulic drive is a natural for reciprocating machine tools. It's being proven daily in the world's finest machine shops." This is but *one* example of the ever increasing application of Oilgear-equipped machine tools. Rockford, and other designers and builders of tools for industry, have discovered that Oilgear *Application-Engineering* means cooperation and teamwork in supplying new production requirements . . . that Oilgear is more than just an "off-the-shelf" source of supply . . . that Oilgear is a Fluid Power design and engineering service based on over 35 years of pioneering and knowledge in precision, "Any-Speed" control, and efficient linear and rotary power systems. Because of this cooperative teamwork in solving problems—coupled with progressively engineered, trouble-free, dependable, Fluid Power control and drive systems—manufacturers have come to trust and depend upon Oilgear . . . the name that protects and enhances "OEM's" reputation, and assures satisfied users.

For practical solutions to YOUR *linear or rotary drive and control problems, call the factory-trained Oilgear application-engineer in your vicinity. Or write, stating your specific requirements, directly to . . .*

THE OILGEAR COMPANY

Application-Engineered Fluid Power Systems

1569 WEST PIERCE STREET • MILWAUKEE 4, WISCONSIN



Rockford Machine Tool Company has used thousands of Oilgear Fluid Power Systems on planers and slotters since 1928, because of: 1: No costly high inertia, reversible, electric motors; complicated control systems, and reduced power consumption and vibration. 2: No racks, screws, gear trains. 3: Infinite speeds from 10 to 300 fpm, with 3 cutting force ranges-independent maximum return speed. 4: Shock-free, instant reversals for efficient short or long stroke cutting. 5: New, complete flexibility in operational control.

Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)
U. S. Steel Corp., Pittsburgh, Pa.

FORGINGS, Upset

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
New Departure Div., Bristol, Conn.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING MACHINES, Cold-rolling

Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

FORMING MACHINES, Multiple-slide

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65 St., Chicago 38, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North Main St., Ampere, N. J.

Hardened and ground to close tolerances, precision-made Universal Locating Pins insure quick, accurate alignment, through even the longest, toughest production runs. And their cost is substantially less than ordinary tool-room pins. Stocked in all standard sizes for immediate delivery . . . in round or relieved, press-fit, threaded or lock screw types. Write today for 98-page catalog describing the complete line of Universal quality products.

203

UNIVERSAL ENGINEERING COMPANY • FRANKENMUTH 2, MICHIGAN

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FURNITURE, Shop

Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air Comparator

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.

GAGES, Automatic Sorting

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, DIAL, Bore, Height, Depth, Thread, Groove, etc.

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Hanlo Gage Co., 18415 Weaver Ave., Detroit 28, Mich.
Lufkin Rule Co., Saginaw, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric Comparator

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
General Electric Co., Schenectady, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.

GAGES, Grinding

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper, Telescoping Thickness

Brown & Sharpe Mfg. Co., Providence, R. I.

GAGES, Multiple Inspection

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Plug and Ring

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., Des Plaines, Ill.

(Continued on page 316)

See why Tool Engineers call these heavy producers,

"MOST MODERN MACHINES OF THEIR TYPE"

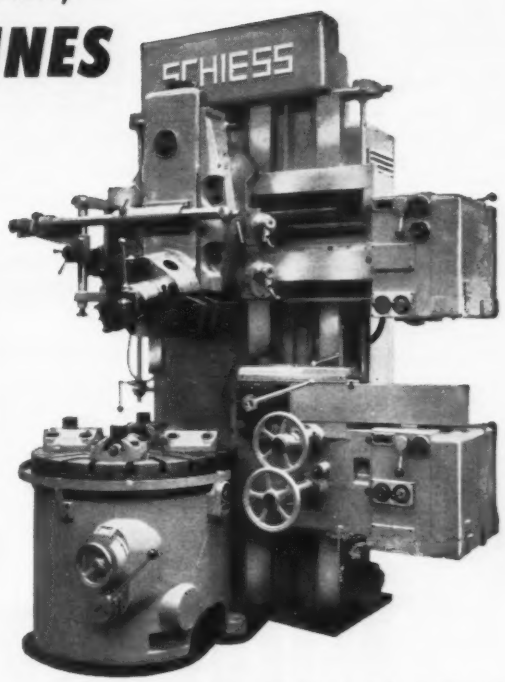
Hydraulic pre-selection of speeds set by handwheel and read on illuminated dial. 16 spindle speeds—ratio 1:50—up to 310 rpm for carbide machining on Model KE 100. Table runs on tapered roller bearings.

Fingertip control for direction of feed and rapid traverse with spring-loaded mono-levers for normal direction plus angular compound feeds. Mono-levers move in same direction as desired feed or traverse movement, simplify correct setting by operator. Specially designed electro-magnetic disc clutches disengage feed instantly with no over-riding or coasting.

Counterbalanced cross rail and side head. Single lever unlocks, raises or lowers, and locks cross rail simultaneously by electro-mechanical controls. *No bolts or nuts to loosen or tighten by hand.*

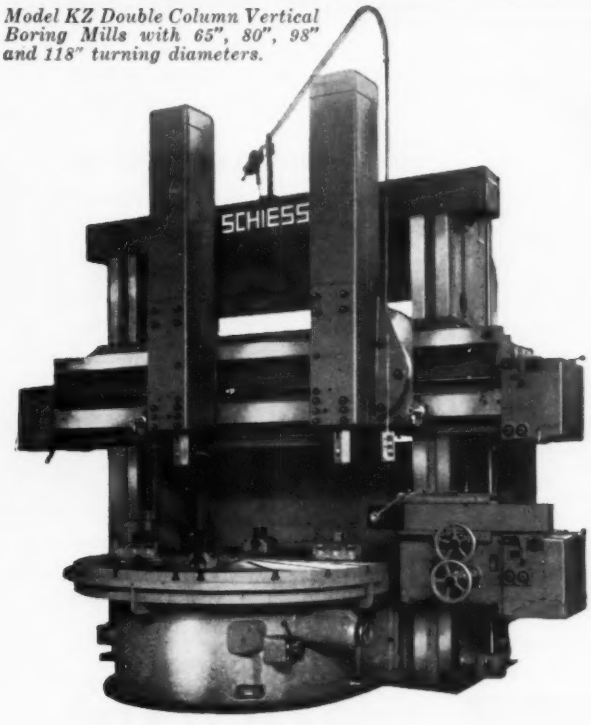
Magnetic dry particle clutch provides vibration-free drive for smooth surface finish. Power is transmitted via belt to clutch from main motor mounted on left side of machine. Instantaneous braking is assured by magnetic dry disc brake.

Copying attachment with electric tracer for use on cross rail or side head.



Model KE Single Column Vertical Turret Lathes with 40", 50" and 65" turning diameters for high-speed carbide machining.

Model KZ Double Column Vertical Boring Mills with 65", 80", 98" and 118" turning diameters.



All operating features of KE Series Vertical Turret Lathes are combined in

SCHIESS KZ DOUBLE COLUMN VERTICAL BORING MILLS, PLUS—

Heads equipped with steel octagon rams can be swiveled—have automatic feed in vertical, horizontal and angular direction and are independent of one another as to amounts and direction of feed. Table operated by three-button pendant control. Standard model KZ Double Column Vertical Boring Mills are available with 65", 80", 98" and 118" turning diameters.

Get to know these products of Europe's largest builder of heavy machine tools. Parts and service are as close as Pittsburgh. An American Schiess engineer will be happy to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on these and all Schiess KE machines.

engineering division

SCHIESS

AMERICAN SCHIESS CORPORATION

1232 Penn Avenue, Pittsburgh 22, Pa.

Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Pressure, Air and Hydraulic

Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.

GAGES, Roll Thread Snap, Adjustable Snap

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

GAGES, Surface Roughness

DoAll Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, VERNIER, Height, Depth, Gear Tooth

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Starrett Co., L. S., Athol, Mass.

GASKETS

Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia 33, Pa.

GEAR BURNISHERS

Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHAMFERING, ROUNDING AND DEBURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHECKING EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel and Spiral

Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cone Drive Gear Div., 7171 E. McNichols Rd., Detroit 12, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR GRINDERS—See Grinding Machines, Gear

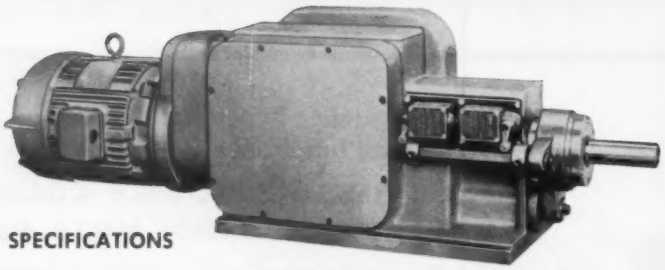
GEAR HOBBERS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

GEAR HONERS

National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.

New! CAM FEED DRILL UNITS BY MILLHOLLAND



#4000 SPECIFICATIONS

Motor Horsepower ..... 3/4 HP-1200 RPM to 5 HP-1800 RPM
Thrust, maximum ..... 1800 lbs.
Length of stroke, maximum ... 6"
Spindle Speeds ... 95 to 4000 RPM
Stroke Cycle .... 1-1/2 seconds to 6 minutes
Capacity in Steel .... 1-1/2" Drill

Write for Bulletin M-4000 giving further details.

The Millholland cam feed drilling unit has a capacity of 5 HP and maximum stroke of 6". This unit employs the very efficient plate cam with pneumatic counterbalance that has been used for years in Millholland Units. The No. 4000 unit is completely enclosed and is lubricated by a micro-fog system which conveys oil from a container external to the unit to all bearing surfaces and gears.

Clutching and declutching of the feed mechanism are controlled electrically through a solenoid air valve mounted in the unit, which in turn operates an air cylinder mounted directly on the clutch. 30 P.S.I. air pressure is sufficient to provide instantaneous response of the feed clutches.

The roller-bearing cam roller is mounted in the spindle carrier and accurately translates the circular lead cut on the cam to a constant linear feed on the spindle carrier. The hardened cam is manufactured from tool steel, and spindle reduction gears are shaved.

A single tool may be used in the spindle, or a multiple head may be attached to the spindle carrier.

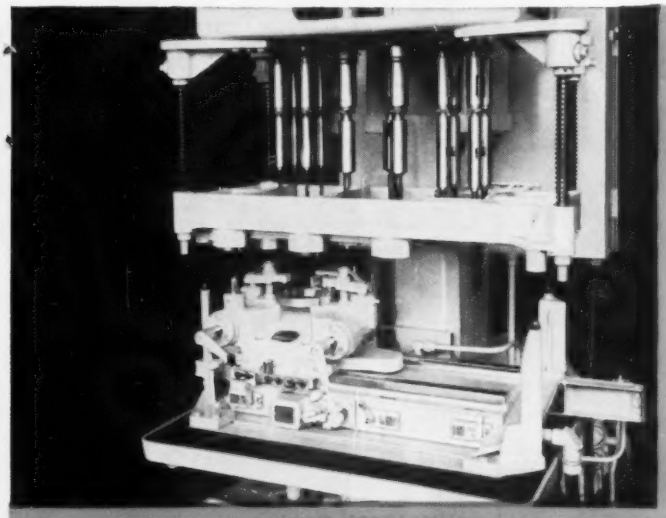
W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd. Indianapolis 20, Indiana

For more information fill in page number on Inquiry Card, on page 241

Natco Naturals

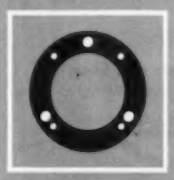
Cost-Cutting Ways
You Can Use
Standard Multi-Spindle Natcos

Any time your parts require machining *more than one hole*–drill, bore, face or tap–it may well be a "Natco Natural." Your standard Natco will produce substantial savings in a surprising number of situations, *even in small job-shop lots!* Call in your nearby Natco field engineer; he'll tell you in short order whether you've got a "Natco Natural" there.

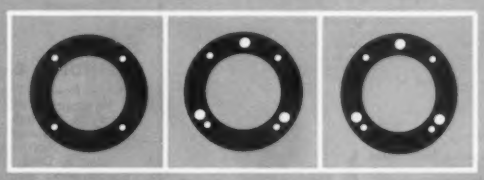


Multiple Drilling Operations on One Part-Face

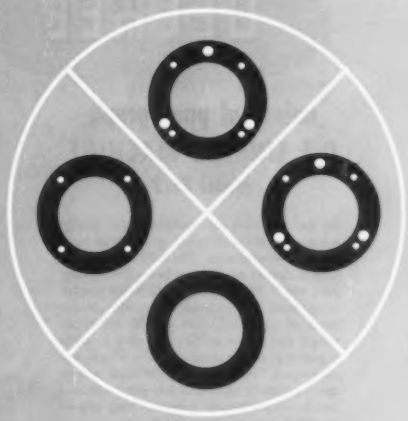
Straight-line indexing *on a Natco H6 produces 49 parts per hour. 4 holes drilled in first position, 3 holes drilled in second position, 4 holes c'bored in third position. One part completed every three strokes. Automatic cycling frees operator for other work. Illustrations below show three other ways of handling this part.*



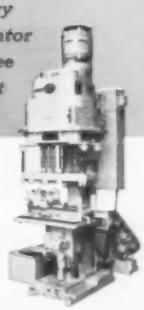
45 parts per hour. *Inexpensive box jig. Operator positions jig under appropriate spindles. One complete part for 3 strokes of machine.*



75 parts per hour. *3-position fixture. Operator shifts parts after each stroke. One part completed every stroke.*



155 parts per hour. *Rotary 4-position index table. Operator unloads and loads while three operations proceed. One part completed every stroke.*



Standard multi-spindle Natcos *range from 1 hp, 10-spindle machines to 25 hp machines with up to 72 spindles. Spindles in standard Natcos are driven through universal joints and located by either adjustable arms or bored slip plates.*

NATCO

National Automatic Tool Company, Inc.

Richmond, Indiana

Multi-spindle drilling, boring, facing & tapping machines. Special machines for automatic production.

Call Natco Offices in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland, Los Angeles; distributors in other cities.

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National Broach & Mch. Co., 5600 St. Jean, Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

GEAR MOTORS—See Speed Reducers

GEAR RACKS
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Stahl Gear & Mch. Co., The, 3901 Hamilton Ave., Cleveland 4, Ohio

GEAR SHAPERS
Fellows Gear Shaper Co., Springfield, Vt.
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Fellows Gear Shaper Co., Springfield, Vt.
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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

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Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
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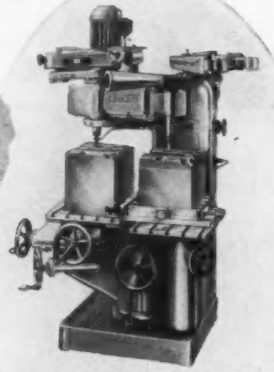
ECONOMICAL, ACCURATE PRODUCTION OF DIES AND MOLDS WITH THE LATEST

DECKEL

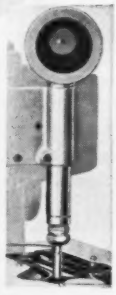
universal pantograph DIE SINKING MACHINE model KF12



Deckel KF12 makes rapid, accurate enlargements or reductions from 1:1.5 to 1:4 as well as 1:1 duplication. The cutting tool covers an area up to 15¾" x 15¾" or up to 10" x 19¾".

Deckel die sinking machines are justly famous for their accuracy, production rate, and ease of operation. The KF12, latest and largest Deckel model, does heavy die-sinking jobs which formerly required much greater investment in equipment. Spindle speeds from 60 to 10,000 r.p.m. enable you to do rough and finish milling, as well as light engraving, on the same machine. The newly developed, "mirror image" milling attachment produces right and left hand dies and molds from the same pattern. Other important features are illustrated below.

Optical contacting device makes rough milling faster, more accurate. And, accurate rough milling reduces time for finishing.



Saddle elevating motor rapidly raises or lowers master and workpiece at the same time.

Circular forming attachment permits generating spherical shapes.

Get in touch with us soon for information on this or other Deckel machines: 2-DIMENSIONAL ENGRAVERS • 3-DIMENSIONAL ENGRAVERS • UNIVERSAL MILLERS • UNIVERSAL TOOL & CUTTER GRINDERS

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Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

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Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
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Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Cone Drive Gear Div., 7171 E. McNichols Rd., Detroit 12, Mich.
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Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
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Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio
Illinois Gear & Mch. Co., 2100 No. Natchez Ave., Chicago 35, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio

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Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hager, E. F. & Son, Queens Village, N. Y.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
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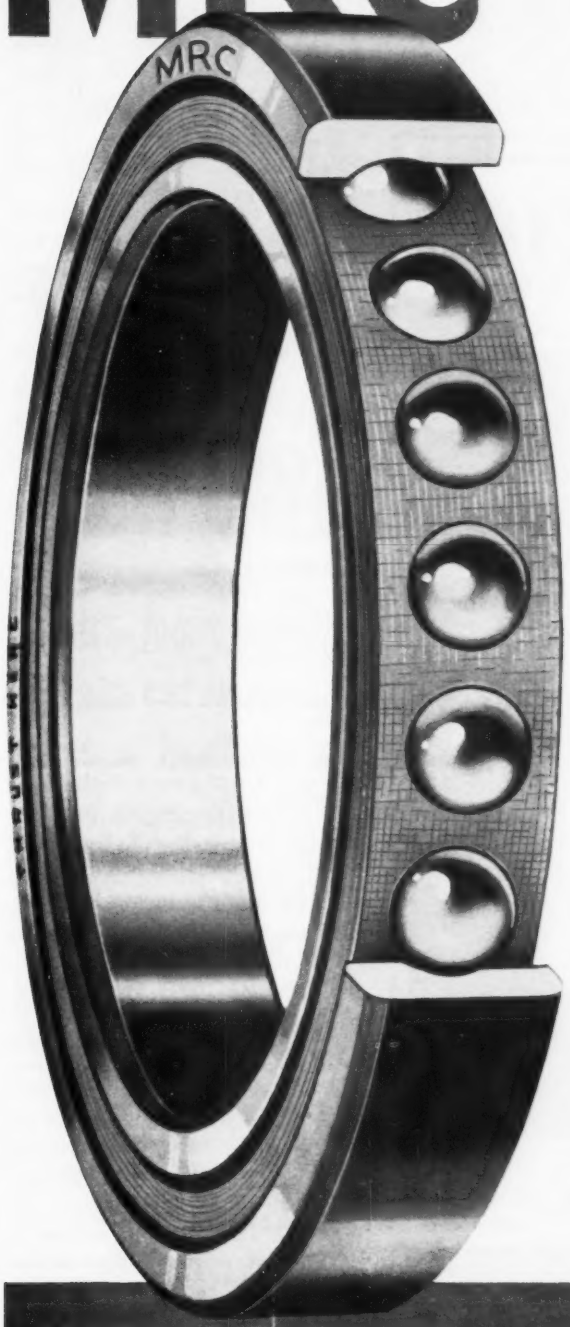

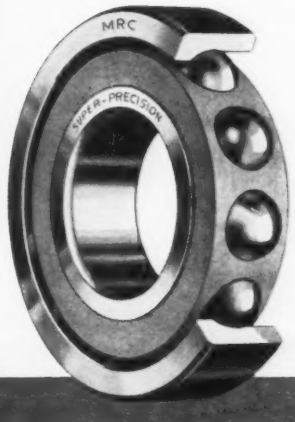

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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

GRINDERS, Face Mill
Kearney & Trecker Corp., Milwaukee 14, Wis.
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDERS, Knife and Shear
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Standard Electrical Tool Co., 2488-90 River, Cincinnati 4, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

GRINDERS, Portable Pneumatic
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Madison-Kipp Corp., Madison, Wis.
Thor Power Tool Co., Aurora, Ill.

GRINDERS, Tap
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
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Rockford Die & Tool Wks., Inc., Rockford, Ill.

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Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
Elox Corp. of Mich., Royal Oak 3, Mich.
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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Homestrand, Inc., Larchmont, N. Y.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
South Bend Lathe Wks., South Bend 22, Ind.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

GRINDERS, Toolpost
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

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GRINDING MACHINES, Abrasive Belt
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
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Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

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Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

GRINDING MACHINES, Cam
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Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Centerless
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(Continued on page 322)

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Compensated Hollow Core Type Demagnetizer is made for a wide range of work — from small screws to large bars — rough finished or finished.
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Self contained.
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★ 50% more power ★ Fewer parts ★ Weight cut down ★ Interchangeable parts ★ Available in 4 speeds

THOR introduces the No. 4 series air grinders—12 new tools more powerful, lighter, and more foolproof than any ever offered.

What a choice! Four models with butterfly throttle, four with grip throttles, four with lever throttles.

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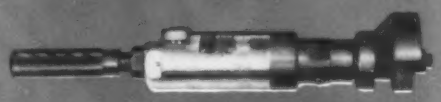

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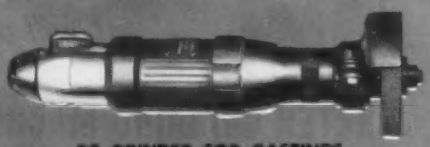

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3 lbs. 11 oz. 7,000, 10,000, 15,000, 18,000 r.p.m. available. Power increased 18%, weight decreased 16%. Wheel sizes 1½" to 3".

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Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
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Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
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Van Norman Co., 2640 Main St., Springfield 7, Mass.

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Lees-Bradner Co., Cleveland, Ohio
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Internal

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Van Norman Mch. Co., Springfield, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

GRINDING MACHINES, Profile

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Roll

Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Surface Reciprocating

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Elox Corp. of Mich., Royal Oak 3, Mich.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Homestrand, Inc., Larchmont, N. Y.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Surface Rotary

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.

(Continued on page 324)

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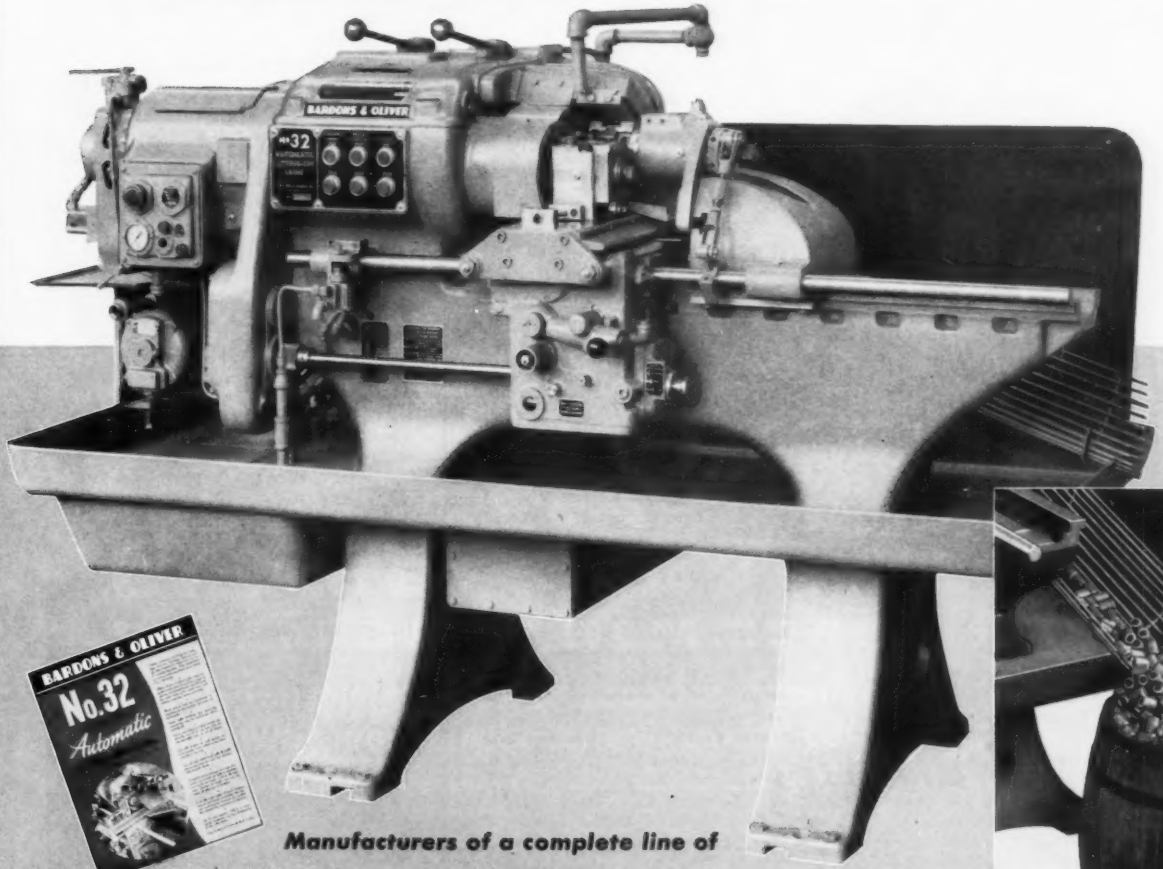
BARDONS & OLIVER No. 32 *Automatic* CUTTING-OFF *Lathe*

This outstanding machine offers high speed production for both *roller* cutting-off and chamfering on tubular work . . . and *blade* cutting-off and chamfering for solid work.

This single spindle machine represents a substantially lower investment than a multiple spindle machine, yet will produce as many or even more pieces per hour. Some light forming and grooving operations can be performed while cutting-off. Complete setup change from one diameter and length of work to another is only a matter of minutes. A wide range of quick change speeds and feeds is available for consistent high production.

Write us on your company letterhead for literature covering *all* the features of the No. 32 Automatic Cutting-Off Lathe.



Manufacturers of a complete line of
Turret Lathes and Cutting-off Lathes

BARDONS & OLIVER, INC.

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Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
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Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch Co., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Parker-Majestic, Inc., 147 Joseph Campau, Detroit, Mich.
Springfield Mch. Tool Co., 613 W. Southern Ave., Springfield, Ohio

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Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Jones & Lamson Mch. Co., Springfield, Vt.
Metal Carbides Corp., Youngstown, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Besly-Welles Corp. (Abrasive Div.), 20 N. Wacker Drive, Chicago 6, Ill.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Niagara Falls, N. Y.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cincinnati Milling Products Div., Cincinnati 9, Ohio
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., Beloit, Wis.
Metal Carbides Corp., Youngstown, Ohio
Norton Co., 1 New Bond St., Worcester 6 Mass.
Simonds Abrasive Co., Tacony and Fraley St., Bridgesburg, Philadelphia, Pa.
Sterling Grinding Wheel Co., Tiffin, Ohio

GROOVING TOOLS, Internal

Scully-Jones & Co., 1906 So. Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

HAMMERS, Drop—See Forging Hammers

HAMMERS, Portable Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Ill.

HAMMERS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa
Edlund Mchry. Co. Div., Cortland, N. Y.
Erie Foundry Co., Erie, Pa.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

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General Electric Co., Schenectady, N. Y.

HARDNESS TESTERS

Shore Instrument & Mfg. Co., 90-35C Van Wyck Exp., Jamaica 35, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEAT-TREATING EQUIPMENT—See Annealing Furnaces, Flame Hardening Machines, Induction-heating Equipment

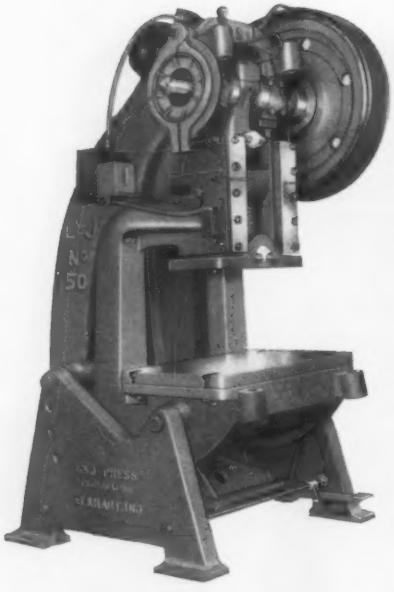
HOBS

Barber-Colman Co., Rock and Montague, Rockford, Ill.

(Continued on page 326)

L&J 50 SERIES

EXTRA CAPACITY WITH PRECISION TO MATCH



Large area dies are no problem when you have an L&J No. 50 Series press with its extra capacity. The exceptionally heavy frame provides maximum rigidity which enables the flanged, box-type ram to maintain precision alignment for precision jobs. The large work area will permit you to run a greater variety of work. Its dependability and tooling ease provide a new high in press efficiency.

Available in geared and non-geared models. Air clutch is available. It will pay you to get complete details now.

SPECIFICATIONS

Capacity: *Model 50*—50 tons, *Model 50B*—56 tons. **Shut Height:** 10" to 25". **Ram Stroke:** 3" to 8". **Ram Adjustment:** 3". **Ram Face:** 24" x 12". **Bolster Plate:** 36" x 24" x 2¼". **Throat Depth:** 12½". **Opening Thru Back:** 22". **Speed:** *Model 50* Non-geared—100 S.P.M., Geared—50 S.P.M. *Model 50B* Non-geared—95 S.P.M. Geared—46 S.P.M. *Higher speeds with air clutch.*

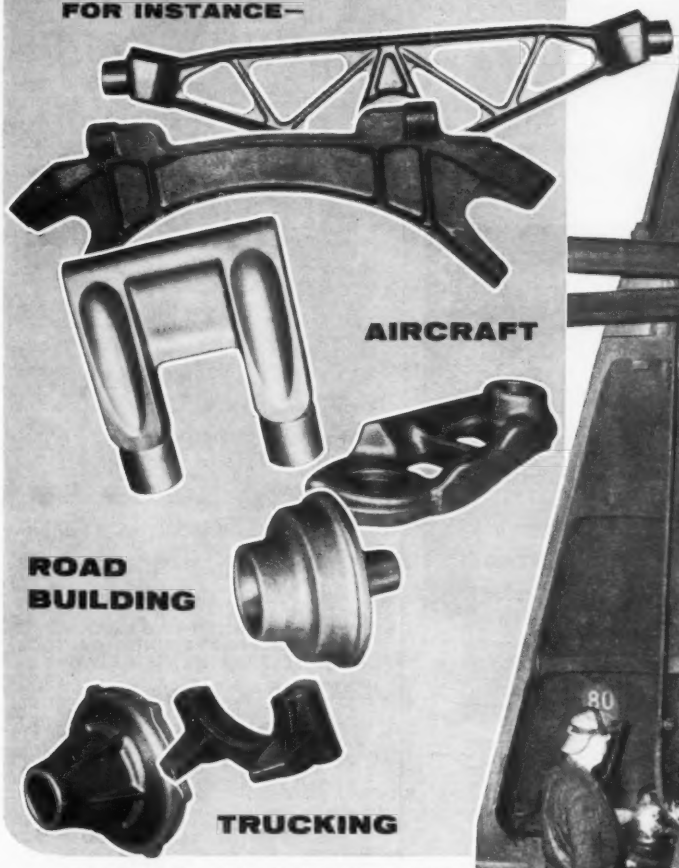
Write for Bulletin L-14

Describes L&J O.B.I. Presses. 23 Models, 14 to 90 tons, geared and non-geared. Also, 20 to 50 ton Double Crank, High Speed, Straight Side Presses.

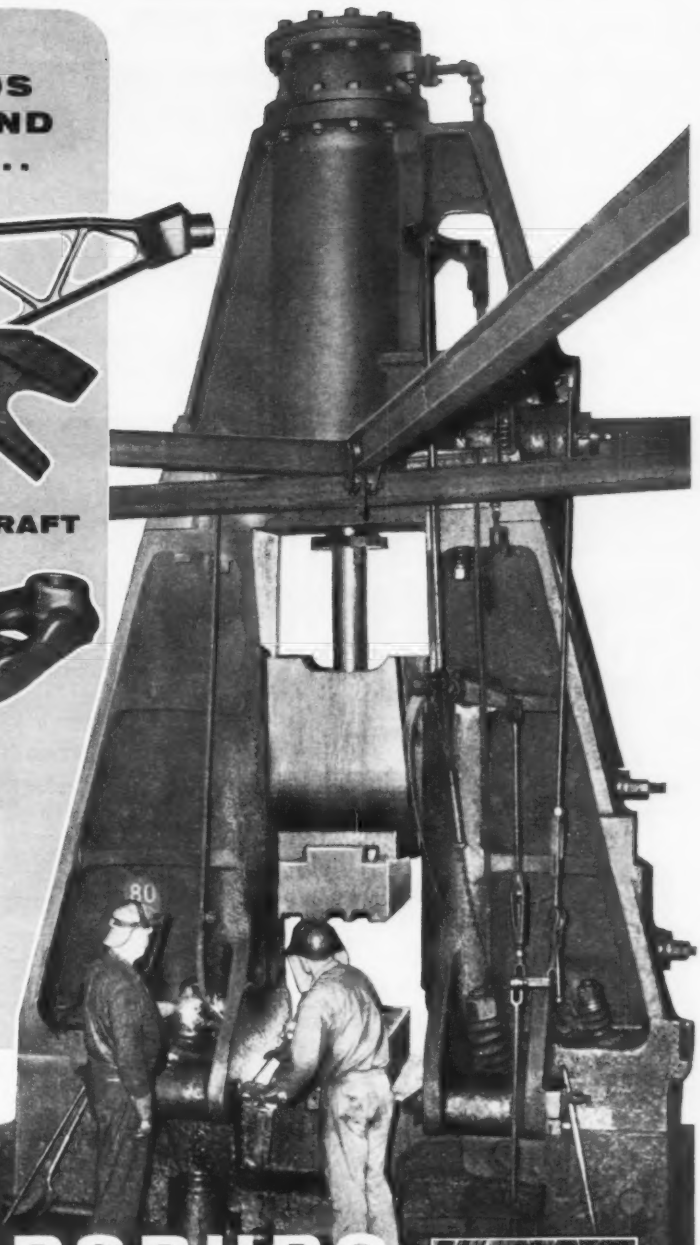
L&J PRESS CORPORATION
1631 STERLING AVENUE, ELKHART, INDIANA

TODAY'S FASTEST EXPANDING FIELDS REQUIRE MORE AND MORE FORGINGS...

FOR INSTANCE—



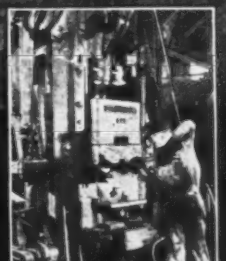
One of the four Chambersburg Steam Drop Hammers at TRANSUE AND WILLIAMS STEEL FORGING CORP., ALLIANCE, OHIO. (*Above*) *Some of the* TRANSUE AND WILLIAMS *forgings produced on these hammers.*



CHAMBERSBURG STEAM DROP HAMMERS

BUILT TO HANDLE MODERN FORGING REQUIREMENTS—*WITH HIGHER PRODUCTION—LOWER COSTS*

Cost per piece produced is the only true test of a hammer's worth and the only true basis for appraising its various features. Every feature of the Chambersburg Steam Drop Hammer is designed and built with but one objective—to produce forgings at the lowest cost per piece, whether that cost be on a basis of the piece in its forged or in its machined state. Write for Bulletin No. 55-L-4.



A rugged—low maintenance teammate is the practically indestructible Chambersburg Steel Side Trimming Press.

CHAMBERSBURG ENGINEERING COMPANY · CHAMBERSBURG, PA.

For more information fill in page number on Inquiry Card, on page 241

Goddard & Goddard Co., Detroit, Mich.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Star Cutter Co., 34500 Grand River, Farmington, Mich.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Illinois

HOISTS, Electric

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Moline Tool Co., 102-20th St., Moline, Ill.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

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Norton Co., 1 New Bond St., Worcester 6, Mass.
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American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

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Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
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Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Drill Head Co., Detroit 34, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Div. of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

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Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
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Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Morris, Robert E. Co., 76 Mamaroneck Ave., White Plains, N. Y.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Mch., 3640 Main St., Springfield 7, Mass.
Wadell Equip. Co., Clark, N. J.
Western Machine Tool Works, Holland, Mich.

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Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
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duMont Corp., 289 Wells St., Greenfield, Mass.
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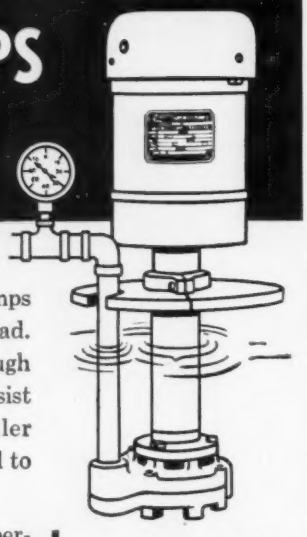
Need Pressure AND Volume? these GRAYMILLS Superflo COOLANT PUMPS give you BOTH!



These compact, dependable coolant pumps can give you up to 10 GPM *at* 65 ft. head. They provide abundant flow even through a maze of pipes and fittings. They resist wear and binding because the impeller floats on a cushion of liquid – no metal to metal contact, no seals, no packing.

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Model 30JH-1 1 HP – Various Lengths. 10 GPM at 65' head. Amazingly compact. Interchangeable with ¼ HP Models.

145

Pumps only or complete pumping units with tanks. Sold by leading Industrial Distributors everywhere. Graymills representatives near you are ready to help with special problems.

WRITE FOR THIS NEW CATALOG 56JH

Showing standard and JIC model centrifugal and gear type Pumps, Pumping Units, Accessories and helpful selection chart.

GRAYMILLS CORPORATION
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GRAY-MILLS GRAYMILLS

Superflo COOLANT PUMPS AND UNITS

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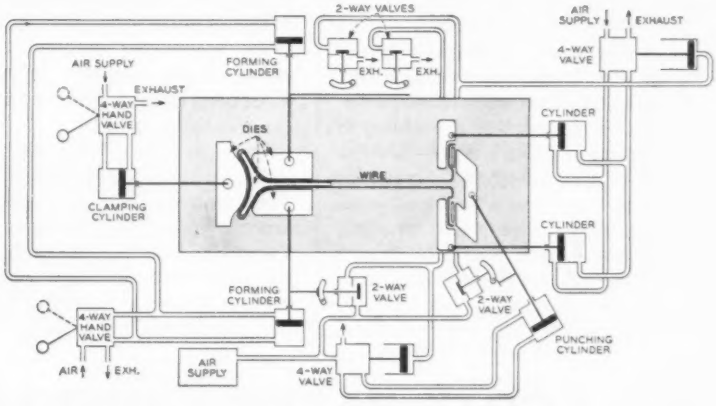
How one plant cuts forming costs 75% with Schrader Air Products adapted to jig

Before this Schrader-powered forming jig was installed, an Ohio plant used heavy punch press equipment and costly welding procedures. Now man-hours and materials have been released for other work, and a single operator produces the finished part in seconds, effortlessly. Cutting the cost of the finished product by ¾!!

Every day Schrader Air Products are being integrated into the most diverse types of manufacturing operations. Versatile, safe, accurate air often makes the difference between profit and loss. And air acts faster than you think! Look into the opportunities in your own plant for modernizing with air. Schrader engineering facilities are available upon request to assist you in planning. Why not mail the coupon today?

Outdoor grill legs formed. Operator places wire between dies. Note Schrader products. Schematic below gives Schrader "Air layout" at end of cycle with wire formed.



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WIPER PROBLEM? Look what Edison did with Scott Wipers!

The changeover from wiping rags to Scott Wipers at the Thomas A. Edison plant eliminated a number of problems and improved production of Voicewriter dictating machines.

Lint from rags was a problem in the wiping of delicate parts—lint-free Scott Wipers solved this. Scratching of lucite parts was a problem—until eliminated by wiping and *wrapping* with Scott Wipers. And Scott Wipers have proved so versatile that they are now used for wiping jobs throughout the plant—in punching, plating, drilling and other operations.

Management no longer needs different wipers for different departments. Wiper inventory is simpler, wiper costs lower, laundering expense and trouble eliminated.

Scott Wipers are 2-ply paper, chemically treated for wet strength and "perf-embossed." This exclusive process* makes them soft and highly absorbent. Want more details? Call the local Scott representative or distributor. Or write Scott Paper Company, Dept. M-75, Chester, Pa.

SCOTT PAPER COMPANY

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Consult your local TV schedules for Scott's program, "Father Knows Best."

*Patent pending

INDICATOR LIGHTS—See Lights, Indicator

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Federal Products Corp., P. O. Box 1027, Providence, R. I.
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National Automatic Tool Co., S. 7th-N. Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The L. S. Co., Athol, Mass.

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Brown & Sharpe Mfg. Co., Providence, R. I.
General Electric Co., Schenectady, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Starrett, The L. S., Co., Athol, Mass.

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Brown & Sharpe Mfg. Co., Providence, R. I.
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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
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Lepel High Frequency Laboratories, Inc., Woodside 77, N. Y.
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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

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Curtiss-Wright Corp., Caldwell, N. J.

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Logansport Mch. Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson-Stillman Co., Roselle, N. J.

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JIG BORERS

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Homestrand, Inc., Larchmont, N. Y.
M. B. I. Export & Import, Ltd., 475 Grand Concourse, New York 51, N. Y.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Metal Carbides Corp., Youngstown 12, Ohio
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 28, Mich.
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

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Bliss, E. W. Co., Canton, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
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DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Size Control Co., Div. of American Gage & Mch. Co., 2500 W. Washington Blvd., Chicago 12, Ill.

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Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
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Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHES, AUTOMATIC—See Chucking Machines

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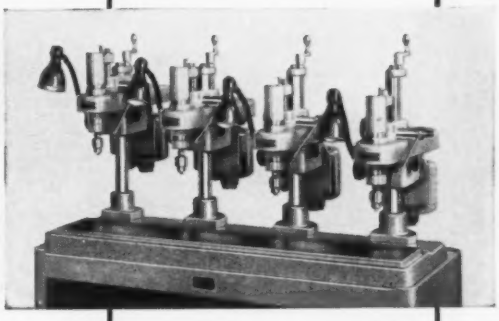
SUPER SENSITIVE, SMALL-HOLE
PRECISION
REPEAT
PRECISION
DRILLING MACHINES



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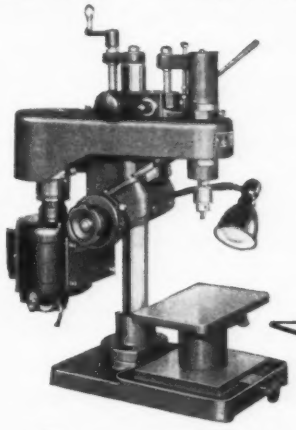

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Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Levin, Louis & Son, Los Angeles 21, Calif.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Car Wheel

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

LATHES, Copying, Duplicating

Pilot Div., Cone Automatic Mch. Co., 30 Rockefeller Plaza, New York, N. Y.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Double-End

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Duplicating

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Sidney Machine Tool Co., Sidney, Ohio
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

LATHES, Engine, Manufacturing

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Eustacchio, S., Brescia, Italy
Homestrand, Inc., Larchmont, N. Y.
Hydra-Feed Mch. Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio
Western Machine Tool Works, Holland, Mich.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Engine, Toolroom

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio
Western Machine Tool Works, Holland, Mich.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Gap

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
Sidney Machine Tool Co., Sidney, Ohio
Springfield Mch. Tool Co., Springfield, Ohio

LATHES, Hollow Spindle

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Roll

American Tool Works Co., Cincinnati 2, Ohio
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bliss, E. W., Co., Canton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio

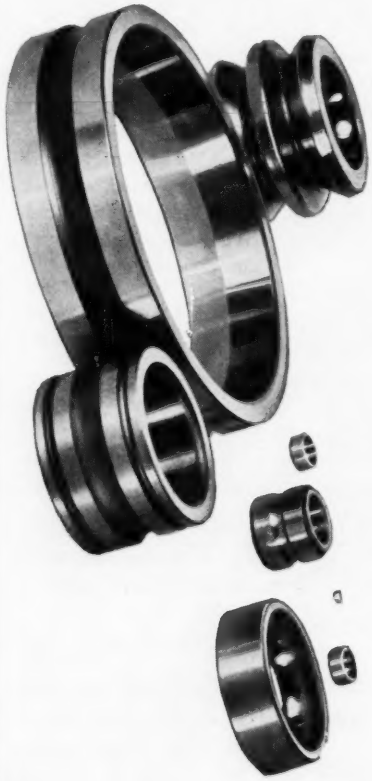
LATHES, Speed, Second-operation

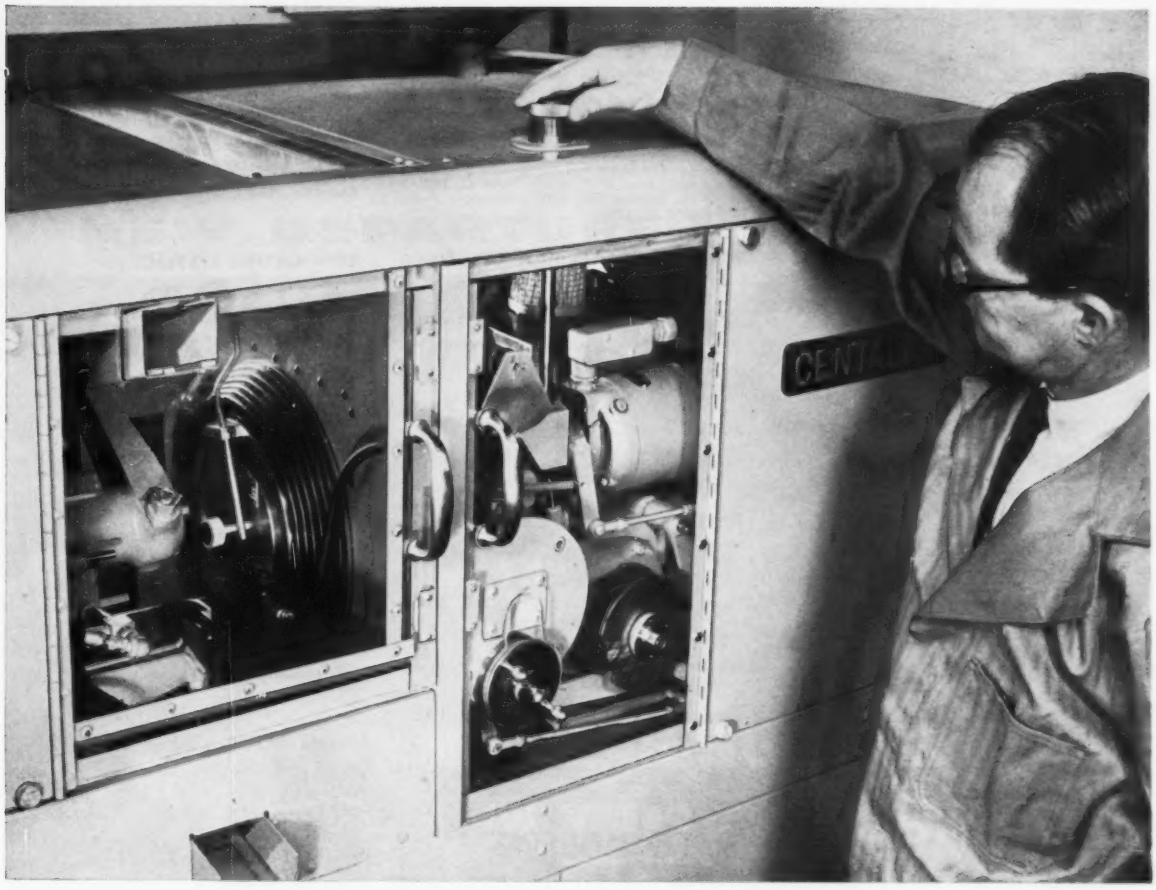
Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., Cincinnati 25, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio

(Continued on page 332)

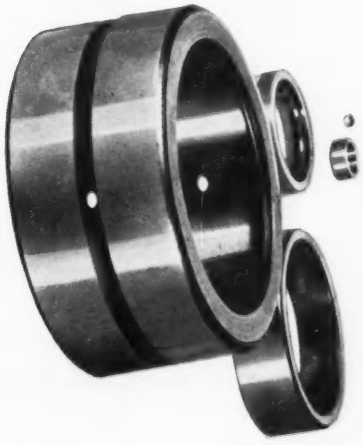
Meet J. K. AIKEN

... one of Bryant's experts on internal grinding of all types. "Ken", who has been with Bryant for 27 years, covers the New England territory.





Fastest Precision Internal Grinder Ever Built!



The Bryant "Centalign" proves, over and over again, that you can cut internal grinding time up to 50%.

The "Centalign" is a *production-proven* internal grinding machine, capable of grinding straight bores, tapers and raceways in precision bearings with incredible speed and constant accuracy.

The "Centalign", by means of its completely new construction principles, dramatically outperforms any and all other comparable equipment on the market. The production gains and cost savings it has given bearing manufacturers throughout the world are so substantial, that no bearing manufacturer can afford *not* to investigate.

Ask for an immediate demonstration!

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Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic
Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type, Saddle Type
Atlas Press Co., Kalamazoo, Mich.
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Levin & Son, Inc., Louis, Los Angeles 8, Calif.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Seneca Falls, Mch. Co., Seneca Falls, N. Y.
Sheldon Mach. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Wks., South Bend 22, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret Vertical—See Boring Mills, Vertical

LAYOUT and DRAFTING TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett, L. S., Co., Athol, Mass.

LEVELS
Lufkin Rule Co., Saginaw, Mich.
South Bend Lathe Wks., South Bend 22, Ind.
Starrett, The L. S., Co., Athol, Mass.

LIGHTING FIXTURES, Machine
Sun-Lite Mfg. Co., 2555 Bellevue Ave., Detroit 7, Mich.

LIGHTS, Indicator
General Electric Co., Schenectady, N. Y.

LIMIT SWITCHES—See Switches, Limit

LUBRICATING OILS and GREASES
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS
Farval Corp., 3249 E. 80th St., Cleveland, Ohio
Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave., Chicago 23, Ill.
Madison-Kipp Corp., Madison, Wis.

MACHINERY, Used and Rebuilt
Eastern Mchry. Co., 1000 Tennessee Ave., Cincinnati, Ohio
Miles Mchry. Co., 2025 E. Genessee Ave., Saginaw, Mich.
Van Keuren Co., Watertown 72, Mass.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

MACHINISTS' SMALL TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Starrett, The, L. S., Co., Athol, Mass.

MANDRELS—See Arbors and Mandrels

MARKING MACHINES and DEVICES
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MATERIAL-HANDLING TRUCKS—See Trucks, Material Handling

MEASURING MACHINES
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Keuren Co., Watertown 72, Mass.

MEASURING WIRES, Thread, Spline, Gear
Sheffield Corp., Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown 72, Mass.

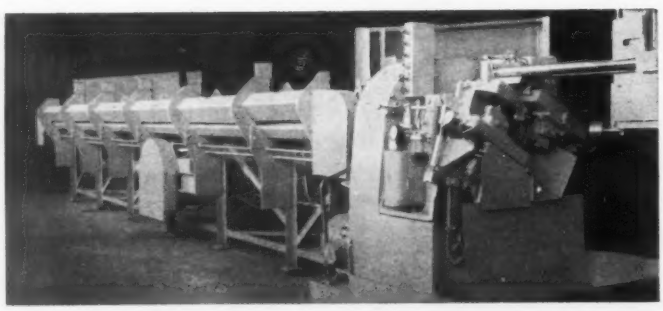
MICROMETER HEADS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoAll Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

MICROMETERS, Outside, Inside, Depth
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROSCOPES, Toolmakers'
DoAll Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

Why Don't You GO MODERN?

"Do it yourself" is sometimes rough,
But it keeps the lady trim and lean—
Provided she works hard enough
With a rusty cutting-off machine.



The chances are a woman would put on weight if she were operating the modern automatic Cutting-off Machine and Automatic Stock Feeder. You simply fill the feeder—with random lengths of tubing with diameters up to 8", or bar stock. Then you push the button and take a coffee-break. The operation is entirely automatic from then on.

This machine is fast—accurate—economical.

Write for catalog and full information.

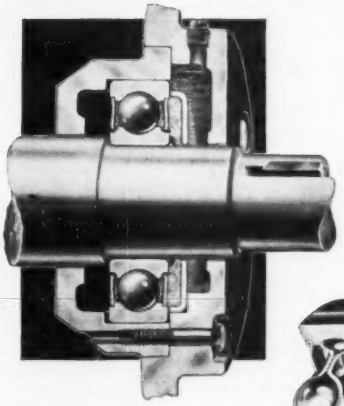
MODERN MACHINE TOOL CO.
2005 LOSEY AVENUE
Jackson, Michigan

FACTS

about

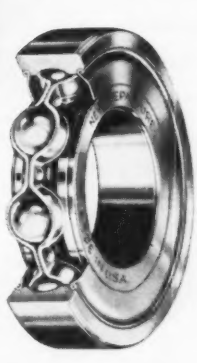
NEW DEPARTURE BALL BEARINGS

Photo: Courtesy of Reliance Electric and Engineering Company



Metering plate adjacent to bearing prevents overlubrication. Excessive grease pressure is relieved *outwards* around shaft. No grease can be forced into motor.

Right: Shielded ball bearing always retains adequate grease supply.



Driving a car shaker is like riding a bucking bronco—and the motor and bearings that do the job have *got to be* tops in every detail for such rugged service.

But even under these rough, tough load conditions, high capacity New Departure ball bearings assure exact rotor location—full electrical and mechanical motor efficiency.

An important feature of the bearing mountings is the use of a "metering plate" which regulates grease flow and prevents excessive grease pressure against the bearings. They cannot be under- or over-lubricated. Yes, motor and bearings are built to maintain precision at operating extremes.

Such motors are safe for long periods without attention—the bearings are fully protected from dirt and there is no grease leakage into the windings. Write for details on New Departure shielded ball bearings.

VISIT NEW DEPARTURE AT THE DESIGN ENGINEERING SHOW, COLISEUM, NEW YORK CITY, MAY 20-23, 1957, SPACE 1240

SEE "WIDE WIDE WORLD" SUNDAYS—NBC-TV

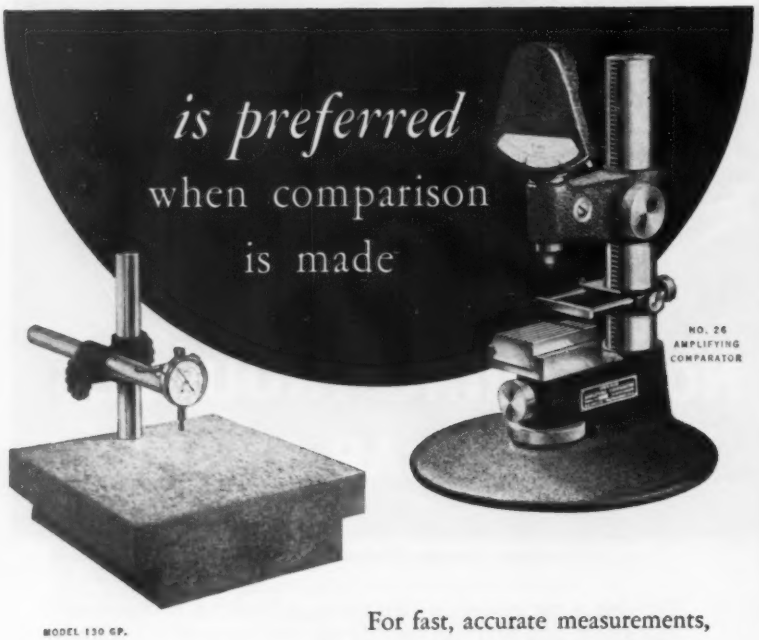
BALL BEARINGS MAKE GOOD PRODUCTS BETTER

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

For more information fill in page number on Inquiry Card, on page 241

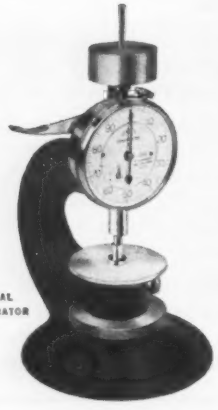
AMES

is preferred
when comparison
is made



NO. 26 AMPLIFYING COMPARATOR

MODEL 130 GP.



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Special comparators are available for measuring resilient materials such as rubber, paper, etc., and for measuring non-yielding materials such as sheet metal, glass and plastic. Write for complete details.

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MILLING MACHINE ATTACHMENTS

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Donley Products, Inc., 1106 Avon Ave., Cleveland 5, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Marac Machinery Corp., Yonkers, N. Y.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench, Hand

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Morris, Robert E., Co., 76 Mamaroneck Ave., White Plains, N. Y.

MILLING MACHINES, Bed Type, Simplex, Duplex

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cincinnati Milling & Grinding Mches., Inc., 470 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Wrks, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Morris, Robert E. Co., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Die Sinking, Duplicating, Profiling

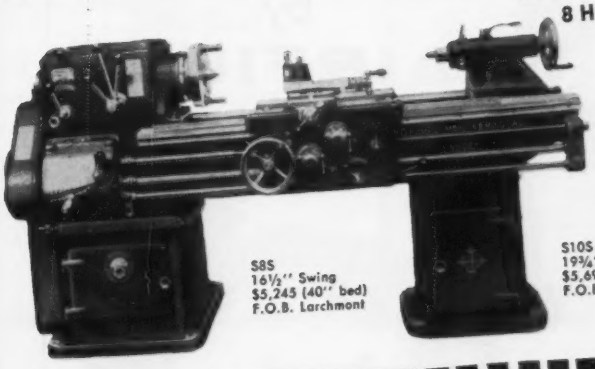
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

(Continued on page 336)

M Product Directory

S8S—S10S
8 H.P.

Weight	4800 lbs.
Spindle Speeds	18
Feeds & Threads With Change Gears	50
Spindle Bore	2 3/8"
Flame Hardening	Optional

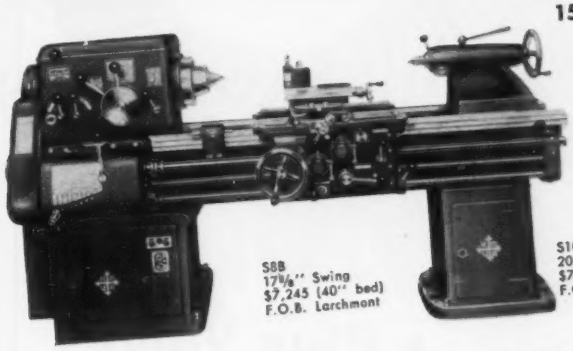


S8S
16½" Swing
$5,245 (40" bed)
F.O.B. Larchmont

S10S
19¾" Swing
$5,695 (40" bed)
F.O.B. Larchmont

S8B—S10B
15 H.P.

Weight	6100 lbs.
Spindle Speeds	18
Feeds & Threads	72
Spindle Bore	2 3/8"
Flame Hardening	Standard



S8B
17⅝" Swing
$7,245 (40" bed)
F.O.B. Larchmont

S10B
20½" Swing
$7,595 (40" bed)
F.O.B. Larchmont

KOPING

Kopings Mekaniska Verkstads A.B.
Sweden

Manufactured in Sweden by the 100 year old Koping Works, these fine machines are designed to meet today's demand for more power, higher speeds and greater stability.

The lathes are manufactured in fourteen types and seven swing sizes ranging from 16" to 59" with power units up to 45 H.P. Bed lengths of 40", 60", 80", 100", 120" are available.

Complete service and engineering facilities are available in the U.S. as well as stock of parts and accessories.

Many Koping lathes and milling machines have been in service in U.S. plants for more than 20 years.

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Note to Dealers: A few exclusive sales territories are still available.

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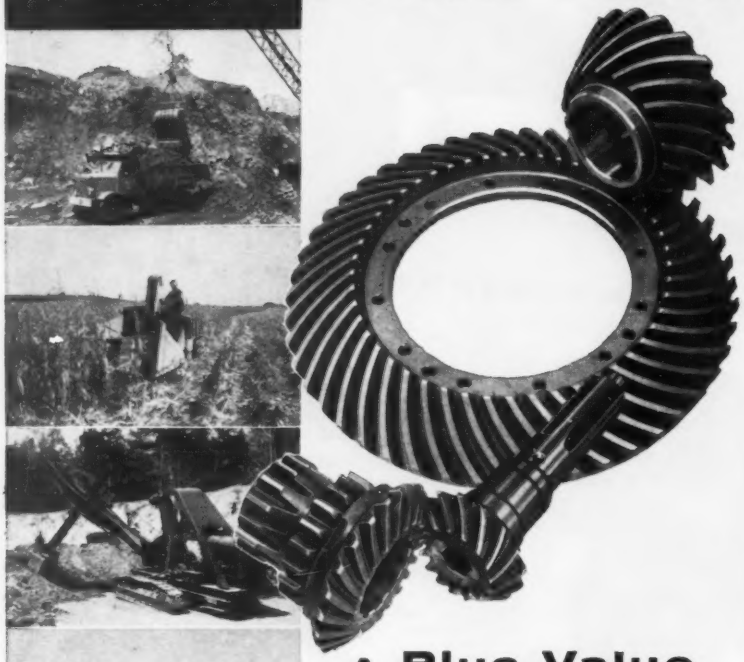
Larchmont, New York

GEARS by FAIRFIELD



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2331 S. Concord Rd.,
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Elox Corp. of Mich., 1830 Stephenson Highway, Royal Oak 3, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Ferndale, Mich.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Rise and Fall

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

MILLING MACHINES, Knee Type Ram

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type, Turret

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MILLING MACHINES, Knee Type, Vertical

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Atlas Press Co., Kalamazoo, Mich.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
South Bend Lathe Wks., South Bend 22, Ind.

MILLING MACHINES, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio

(Continued on page 338)

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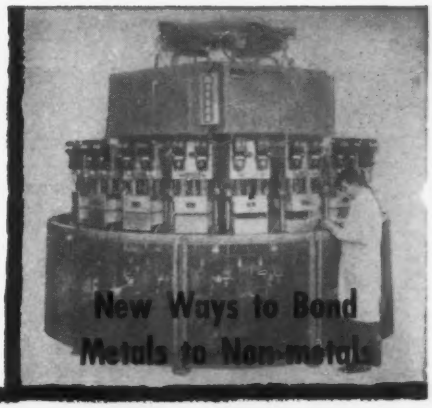
New fast functional chamfering of almost any kind of part



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All Kinds of Multi-station Machines

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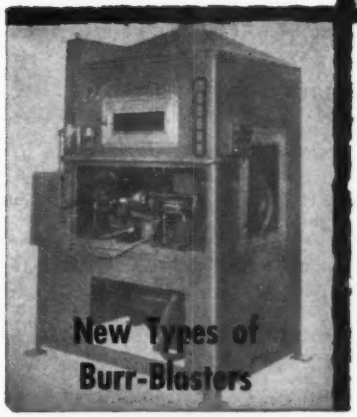


New Types of Burr-Blasters

New machines for non-machining operations on machined parts

Automated Pressure-Testing

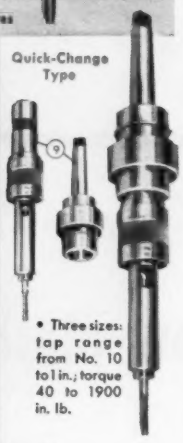
Stop tap breakage and scrap

SCULLY-JONES SAFE-TORQUE DRIVERS

NOW AVAILABLE IN NEW STYLES AND CAPACITIES

Heavy-Duty Safe Torque Tap Drivers
• Two sizes: tap range from ½ to 1½ in.; torque 500 to 2400 in. lb.

These benefits . . .	for these reasons . . .	result from these PREMIUM features
PREMIUM TOOL LIFE	Reduce tap breakage.	1. One-shot clutch and cam-drive collet completely disengage tap from driver.
	Control adverse tapping conditions.	2. Pre-set torque remains constant. Wide range of settings.
PREMIUM QUALITY TAPPED HOLES	Produce uniform, accurate threads.	3. Freewheeling action eliminates impact and objectionable vibration.
	Help prevent use of dull or improperly sharpened tap, or wrong tap for job.	4. Releases instantly at proper setting.
		5. Tension and compression type compensates for feed variation between spindle and tap.
PREMIUM PRODUCTION EFFICIENCY	Operator gains confidence, more free time for other work.	6. No noise or impact on release. Tension and compression type spring loaded.
	Use higher speeds on all tapping jobs.	7. Operates at any speed taps can take.
	Reduce downtime.	8. Gives dependable control over adverse machining conditions.
		9. Quick-change type—change tools without stopping machine.
PREMIUM PROFIT OPPORTUNITY	Driver has long service life.	10. Freewheeling action minimizes wear.



Quick-Change Type

• Three sizes: tap range from No. 10 to 1 in.; torque 40 to 1900 in. lb.

Tension and Compression Type
• Two sizes: tap range from No. 10 to ⅜ in.; torque 50 to 700 in. lb.

SCULLY JONES

Call your Scully-Jones factory-trained representative or distributor for complete information and prices.

PRECISION HOLDING TOOLS

"Precision Holding" for holding precision

Scully-Jones and Company, 1906 South Rockwell St., Chicago 8, Ill.

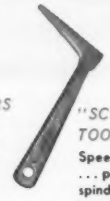
for profit-minded tool buyers!

COUNTERBORES and COUNTERSINKS

Give you rigidity and concentricity needed for accurate work, longer life.

LIVE CENTERS

Take shock and abuse of heavy loads turning at high speeds.



"SCULLY-DRIFT" TOOL EJECTORS

Speed tool changes . . . protect tools, spindles, and bearings. Twist-of-the-wrist ejects tool or holder.

CENTER DRILL DRIVERS

Offset splined section gives positive drive in drill flutes and protects cutting edges.

DRILL STOPS

Make control of drill depth simpler, more accurate. Sleeve snaps out for fast tool change.

M Product Directory

Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Spar

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Thread

Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Lees-Bradner Co., The, Cleveland 11, Ohio

MOLDING MACHINES, Plastic

Baker Brgs., Inc., 1000 Post St., Toledo 10, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Watson-Stillman Co., Roselle, N. J.

MOTORS, Electric

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
General Electric Co., Schenectady, N. Y.
Howell Electric Motors Co., Howell, Mich.
Lincoln Electric Co., Cleveland 17, Ohio
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio

MOTORS, Hydraulic

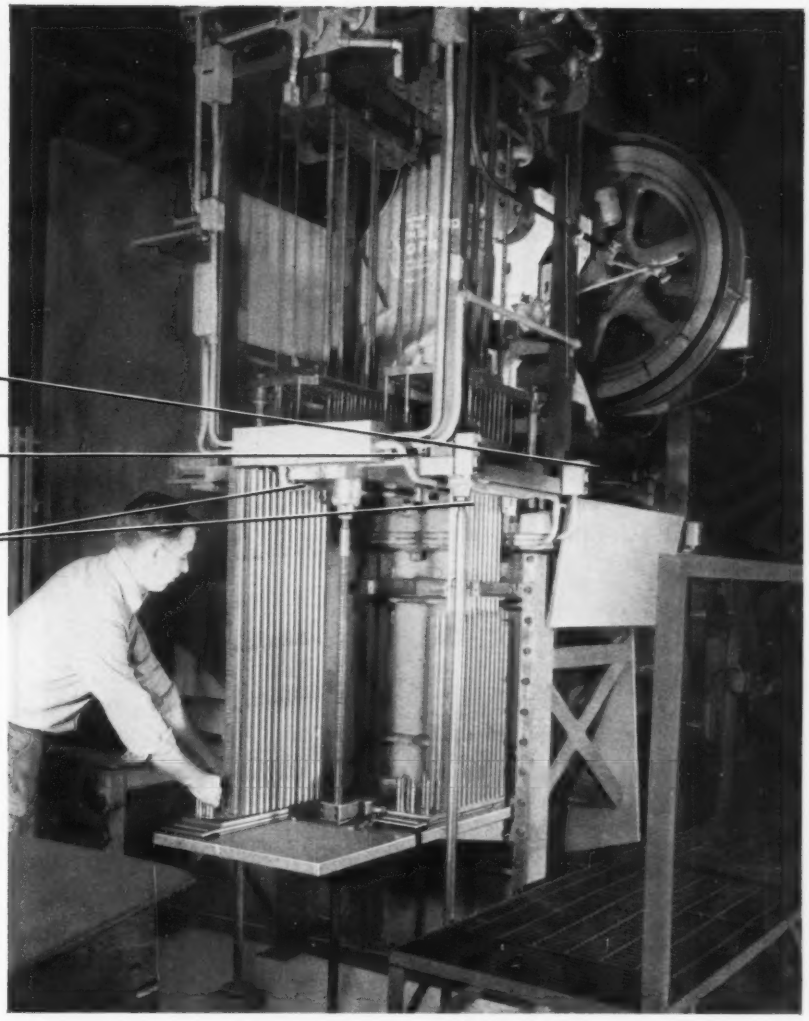
Barnes, J. S., Corp., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

MULTIPLE INSPECTION GAGES—See Gages, Multiple Inspection

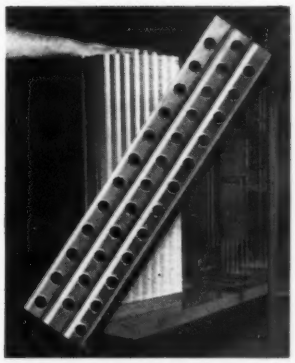
MULTIPLE-STATION MACHINES, Dial Type

Avey Drilling Mch. Co., 25 E. 3rd St., Covington, Ky.
Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.

(Continued on page 340)



Tooled presses save assembly time at York



Aluminum fins (.006" or .008" gauge) are fabricated and stacked at rates up to 180 per minute.

York Division of Borg-Warner, wanted to combine a fabricating and assembly operation in the production of fin coils for air conditioning and refrigeration systems. *Objective: eliminate a time-consuming manual stacking operation that, in a period of expanding production, would grow increasingly expensive.*

V & O supplied equipped presses for the job. Fins, complete with skip-corrugation, holes and spacers, are made in a two-station die; then collected in a stacking mechanism and pushed down onto tubes.

Presses that integrate or combine operations are the primary business of V&O. Our long-slide presses are designed for automation. Our engineering is geared for it. We would welcome a chance to go over the possibilities of using mechanized presses to integrate or combine operations in your plant. Please write or call us.

THE V & O PRESS COMPANY

DIVISION OF EMHART MFG. CO.

341 UNION TURNPIKE, HUDSON, NEW YORK

Presses and methods that automatically reduce costs

For more information fill in page number on Inquiry Card, on page 241

I-R TORSION BAR TORQUE CONTROL

TORQUE CONTROL IMPACTOOLS

consistently run nuts to prescribed torques

I-R Torsion-Bar Impactools now assure top quality control on these 3 operations:

1. *Assembling differential main bearing caps at 450 ft. lbs. both before and after machining as shown above.*
2. *Preloading differential drive pinion bearing with Impactools set at 375 ft. lbs.*
3. *Assembling wheels to wheel hubs at 425 ft. lbs.*

Quality control has risen to a new high for this large manufacturer of farm equipment since I-R Torsion-Bar Torque Control Impactools were installed.

These Impactools are the *only* power wrenches that deliver full power and speed until the preset torque is reached, and then instantly and automatically shut off.

Now, with Torque Control Impactools, the company consistently runs nuts to prescribed torques, saves time, improves quality and eliminates hand torque checking operations.

Write for Bulletin 5170 for proof of how these amazing Impactools can improve quality and cut costs on your own applications.

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8-524

Federal Prod. Corp., 1144 Eddy St., Providence 1, R. I.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
LaSalle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Milholland, W. K., Mchry. Co., Inc., Indianapolis 20, Ind.
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

MULTIPLE-STATION MACHINES, Transfer Type

Avey Drilling Mch. Co., 25 E. 3rd St., Covington, Ky.
Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Watson Ave., Springfield, Mass.
Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kearney & Trecker Corp., Milwaukee, Wis.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Millholland, W. K., Mchry. Co., Inc., Indianapolis 20, Ind.
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9399 S. Kenwood Ave., Chicago 19, Ill.

NIBBLING MACHINES

Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Wales-Strippit Corp., Akron, N. Y.

NICKEL AND NICKEL ALLOYS

Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.

NUT SETTERS—See Screwdrivers, etc.

NUTS—See Bolts, Nuts and Screws

OIL GROOVERS

Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OILERS AND LUBRICATORS

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.
Wicaco Mch. Corp., Philadelphia, Pa.

OILS, CUTTING SOLUBLE—See Cutting and Grinding Fluids

OILS, Lubricating—See Lubricrating Oils and Greases

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 - 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

OPTICAL FLATS
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Van Keuren Co., Watertown 72, Mass.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Watson-Stillman Co., Roselle, N. J.

PAINTING EQUIPMENT, Spray—See Spraying Equipment, Metal

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Lufkin Rule Co., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

PIPE, Steel, Stainless, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Co. (Tubular Prod. Div.), Beaver Falls, Penna.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE AND TUBING MILLS, Electric-weld
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

PIPE AND TUBING, Brass and Copper
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Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.

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finest line of expanders
in operation

1957 Design Engineering Show
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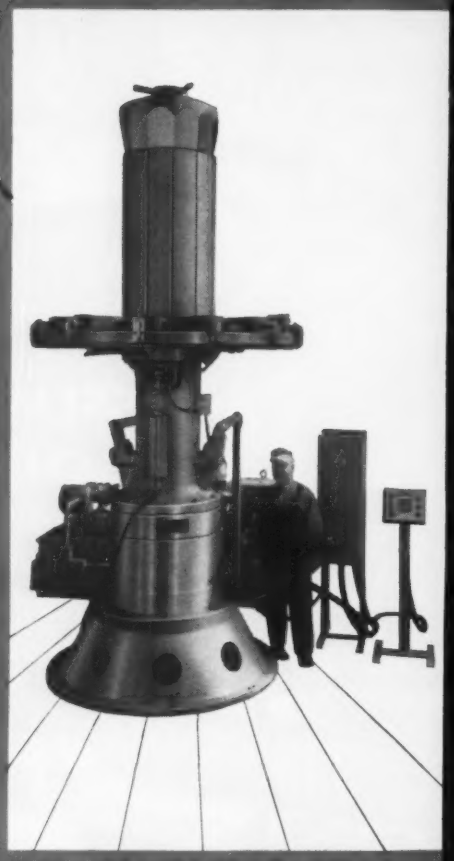

GROTNES No. 26-HV-680 HYDRAULIC EXPANDER for sizing and forming round and polysided parts. Capable of expanding 12.3 Sq. In. of metal having a yield strength of 100,000 psi. This machine is similar to the one that will be at the Show, and is typical of Grotnes Hydraulic Expanders. Tonnages from 25 to 1600 (Drawbar Pull).

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PLANER JACKS—See Set-up Equipment

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Rochester, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

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Dow Chemical Co., Midland, Mich.
Eastman Kodak Co., 343 State St., Rochester 4, N. Y.
Gisholt Mch. Co., Madison, Wis.
U. S. Steel Corp., Nat'l Tube Div., Pittsburgh, Pa.

PRESS BRAKES—See Brakes, Presses and Bending

PRESS FEEDERS, Automatic

Bliss Co., E. W., Canton, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., East Orange, N. J.

PRESS STACKERS and STORAGE SHUTTLES

Michigan Production Eng. Co., Hazel Park, Mich.

PRESSES, Arbor

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
du Mont Corp., Greenfield, Mass.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., Logansport, Ind.
Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Assembling

Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Colonial Broach & Machine Co., Box 37, Detroit 13, Mich.
Detroit Broach Co., Inc., 950 S. Rochester Rd., Rochester, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo, N. Y.

PRESSES, Blanking, Stamping

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bath, Cyril Co., 32324 Solon Rd., Solon, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.

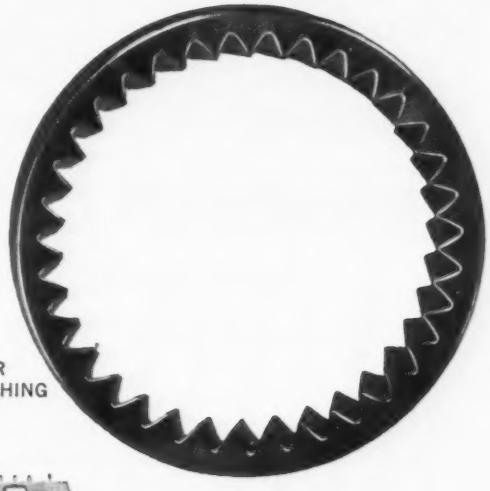
(Continued on page 344)

OSBORN BRUSHING METHODS *worthy of your confidence*

Automated finishing geared to your production

...at rates up to 300 pieces per hour

BEFORE BRUSHING



AFTER BRUSHING

THE automotive pump gears shown above are typical of a wide range of parts that can be precision finished with Osborn's line-production method.

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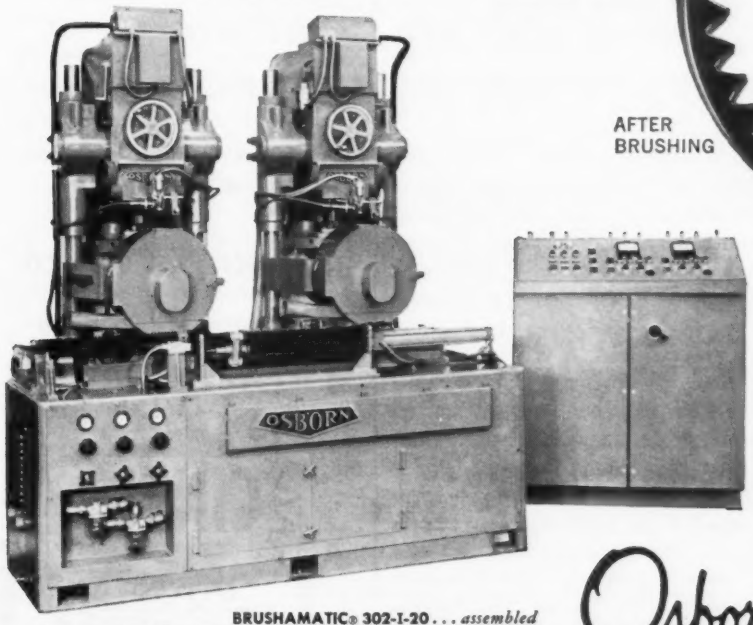
AUTOMATES FINISHING OPERATIONS . . . Takes parts right from your production lines, feeds them to rotating power brushes, delivers them precision-finished to micro-tolerances where necessary.

. . . *all without manual handling*

Automated power brushing is just one example of the many ways Osborn is helping to improve production techniques. An **O**sborn **B**rushing **A**nalysis, made in your plant without obligation, may point out important benefits to your company. Write *The Osborn Manufacturing Company, Dept. D-34, Cleveland 14, Ohio.*



BRUSHAMATIC® 302-I-20 . . . *assembled from standard Brushamatic components which have been used in various combinations to fill a wide range of finishing requirements.*

Send TODAY for the new 20-page Brushamatic Booklet

Osborn Brushes

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES • BRUSHING MACHINES • FOUNDRY PRODUCTION MACHINERY

For more information fill in page number on Inquiry Card, on page 241

They're tough, they're versatile

. . . and amazingly low in cost!

ACE

STUB DRILLS

The short, heavy duty flutes of Ace Stub Drills are ground into top quality pre-hardened high speed steel to give you keener cutting lips, extra strength, longer drill life. Ideal for close-to-work screw machine operations and portable drilling. And they're now stocked in 140 standard sizes that cost approximately 20% less than equivalent jobber length drills!

Call your local Ace Drill Distributor today!

NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!

ACE DRILL
ADRIAN, MICHIGAN
ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

Federal Machine & Welder Co., 1745 Overland Ave. N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 N. 18th St., East Orange, N. J.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Briquetting

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Closed-Die Forging

Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland 17, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Coining, Embossing

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Die Sinking (Hobbing)

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St. Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

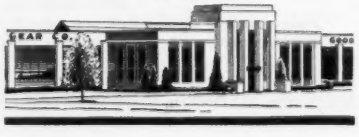
A little GOLD in our hair

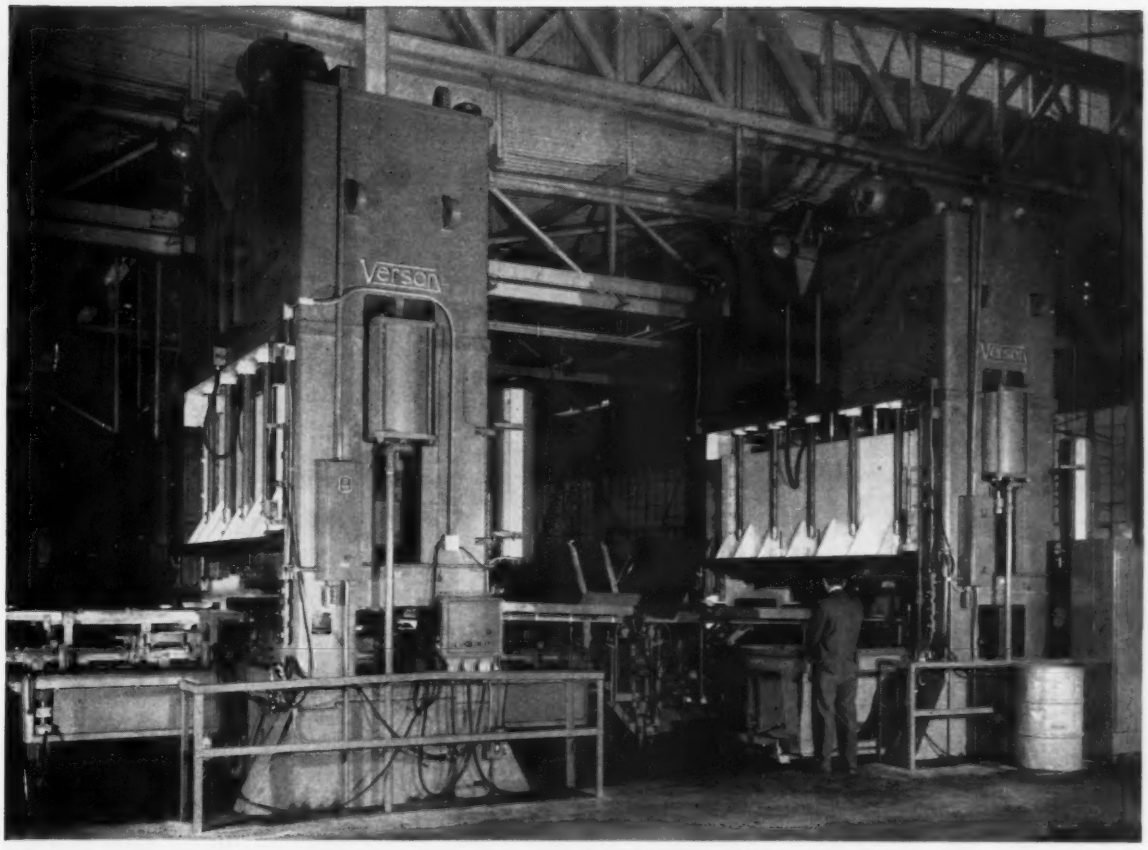
PRESIDENT, THE CINCINNATI GEAR CO.

We're older than we look. In fact, our firm is 50 years old this year, and while we haven't *actually* taken to tinting our hair gold, we *are* doing our best to let everyone know about this, our golden anniversary. Because we think it's something of an accomplishment — 50 years of uninterrupted progress and growth and leadership in gear-making that have made our reputation "good as gold." That reputation has been as much the result of adhering to some old-fashioned ideas about craftsmanship, service and attention to details as it has been the result of aggressive pursuit of the latest technological advancements in gear manufacture. It's a reputation we've worked hard to earn in the 50 years past, and one we'll work equally hard to perpetuate in years to come . . . a reputation for producing the best in custom "gears . . . *good gears only.*"

THE CINCINNATI GEAR CO.
CINCINNATI 27, OHIO
Fifty Years of "Gears—Good Gears Only"

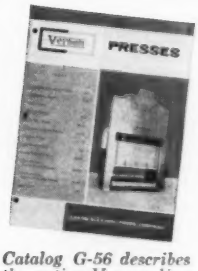
CINTI®





Two 400 ton Verson Presses

perform as one production unit to manufacture automatic dryer bodies



Catalog G-56 describes the entire Verson line and gives design details and specifications. Write for your copy, today.

The two 400 ton Verson eccentric presses shown above, integrated with automatic handling equipment and controlled by one operator, perform as a single production unit in the manufacture of automatic clothes dryer bodies for a leading appliance manufacturer. The press on the left blanks and forms the dryer body and draws the front face with door opening. The parts then move automatically to the press on the right for flanging and punching operations. Speed is 14 strokes per minute.

Verson presses are engineered to become an integral part of the production process in which they are used. If you make stampings of any kind, this approach to your problems can mean big savings. Send an outline of your requirements today and put real production know-how to work for *you!*

A Verson Press for every job from 60 tons up.

TRADE Verson MARK

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

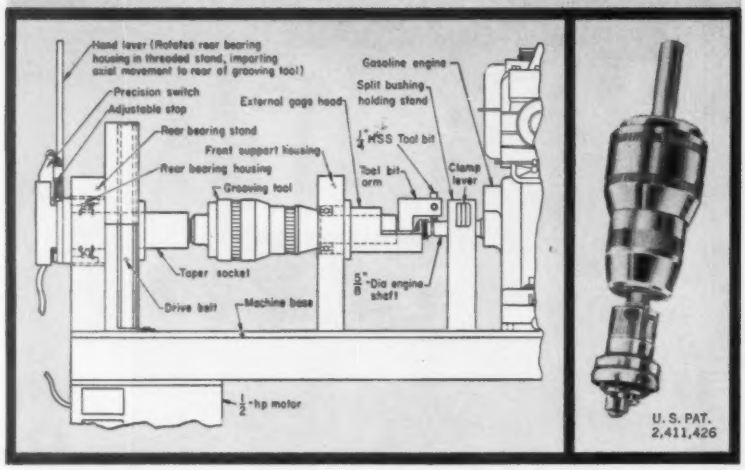
VERSON ALLSTEEL PRESS CO.

9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • 8300 S. CENTRAL EXPRESSWAY, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

For more information fill in page number on Inquiry Card, on page 241

Groove cut in shaft of fully assembled engine with WALDES TRUARC GROOVING TOOL



To install a small gear, Clemson Bros. must machine a recess (Tolerance: +.033" —.000") in a shaft of the engine for their power lawn mowers.

Engines arrive fully assembled. Normal procedure was to rotate the shaft. That involved removing a spark plug, mounting each engine firmly and accurately on a lathe, securing a gear or sprocket on the shaft, driving the shaft and moving the stationary cutting tool into position. The engine had to be reassembled after grooving.

All this costly time and labor was eliminated by holding the shaft stationary and *using a tool that rotates*—the Waldes Truarc Grooving Tool, equipped with an external grooving attachment. Because grooving dimensions are pre-set on the tool, there are no rejects caused by inaccurate cutting.

No recessing problem is too tough for this amazingly versatile tool. It's so simple, even unskilled labor can use it accurately...so cost-saving, it often pays for itself on a single small run!

Write now for 20-page manual containing full information on Waldes Truarc Grooving Tool.

WALDES
TRUARC®
GROOVING TOOL
WALDES KOHINOOR, INC.
47-16 AUSTEL PLACE, L. I. C. 1, N. Y.

SEE THE TRUARC EXHIBIT AT THE DESIGN ENGINEERING SHOW, NEW YORK COLISEUM, MAY 20th TO MAY 23rd. BOOTH NO. 1010.

PRESSES, Die Tryout

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Drawing

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Cincinnati Milling & Grinding Machines, Inc., 4710 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Extrusion

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Foot

Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Horning

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.

(Continued on page 348)

Put HOWELL in Your Product Picture

...and gain the PLUS values in power that count!

Are you selecting punch press motors that must "live in" and like the hot spots high up under factory roofs? Want a motor that's built to fill the constant stop-and-start requirements of heavy-duty machine tool service, yet be as good looking as tomorrow's most streamlined and automated machines? Then specify Howell, as machine tool builders and plant engineers throughout the metal working industry have been doing for years. Among many good reasons are these:

EXTRA DEPENDABILITY that challenges the years. Howell's new principle of heat-source ventilation . . . double sealed bearings . . . tough rolled steel frames and precision fitted cast iron end plates . . . these and many more are plus values that *count!*

AN UNSURPASSED REPUTATION for engineering excellence and quality manufacture . . . built up by Howell in over 40 years of serving industry's motor requirements.

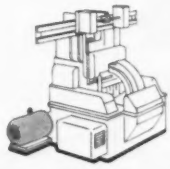
TOPS IN APPEARANCE. No other industrial motors have such smooth, unbroken contours . . . without a fin or rib to mar their looks or catch dust deposits.

Howell makes virtually every type of AC industrial motor, fractional and integral to 300 hp, in all standard enclosures, in rerated and non-rerated frame sizes, also a wide range of gearmotors and brake motors.

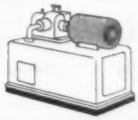
among leading machine tool manufacturers who use Howell motors are these:

The Cross Co. • E. W. Bliss Co. • Warner-Swasey Co. • Ex-cell-o Corp. Snyder Tool and Engineering Co. • The Carlton Machine Tool Co. The Cincinnati Milling Machine Co. • Sundstrand Machine Tool Co.

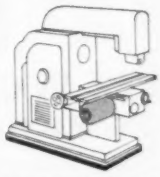
GRINDERS



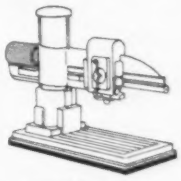
LATHES



HYDRAULIC SYSTEMS



MILLING MACHINES



RADIAL DRILLS

A Howell sales engineer can give you valuable assistance on any motor application. Wire or 'phone collect . . . or drop us a line . . . you'll get prompt action. Howell Electric Motors Co., Howell, Michigan.

HOWELL *motors*

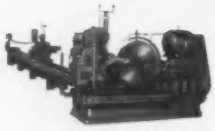
. . . precision built for industry since 1915

BETTER PRODUCTION at LOW COST!

Four great lines by The Cleveland Tapping Machine Co., Cochrane-Bly, The machine division of Taylor & Fenn and The H. P. Townsend Mfg. Co., are all now manufactured under the Townsend banner.

TOWNSEND OF HARTFORD

4 complete lines of automatic machines in 1



COCHRANE-BLY* multiple cutting automatic metal sawing machine.

*Subsidiary of H. P. Townsend

Townsend of Hartford is giving added new significance to Low Cost Automation combined with highest precision and versatility. By integrating four complete lines under one management, Townsend gives industry a big new choice of machines designed to meet production needs in every industry.

Our complete engineering and production consulting service is at your beck and call. No obligation.

The H. P. TOWNSEND MANUFACTURING CO.
HARTFORD 10, CONN.

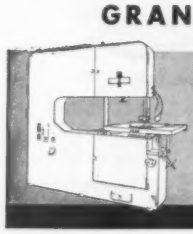
FRICTION SAWING

with Tannewitz HIGH SPEED BAND SAWS

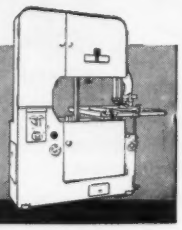
FASTEST, BEST MEANS OF CUTTING METALS

If you are not familiar with the advantages of friction sawing with these machines, by all means drop us a line asking for "Friction Sawing Data." You can save many times the cost of a Tannewitz High Speed Band Saw and greatly expedite production by using it to cut sheets of both hard and soft steel, formed or flat, trimming malleable and steel castings, cutting armor plate or many other materials. Write NOW!

THE TANNEWITZ WORKS ☎ GL-6-1729
GRAND RAPIDS, MICHIGAN



TANNEWITZ DIE-SAWS
24", 36", 48", 60" CAPACITIES
for CONTOUR SAWING, FILING, POLISHING
The smoothest, fastest, most trouble-free Di-Saws on the market. Write for bulletin.



Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Notching

Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit Corp., Akron, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Punching, Piercing

Bath Cyril Co., 32324 Aurora Rd., Solon, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7400 S. Loomis Blvd., Chicago 36, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood, Chicago 19, Ill.
Wales-Strippit Co., Akron, N. Y.
Wiedemann Machine Co., 4272 Wissahicken Ave., Philadelphia 32, Pa.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Quenching

Gleason Wks., 1000 University Ave., Rochester 3, N. Y.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.

PRESSES, Rubber-Forming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Trimming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio

Bearings of the Future for Machines of Today

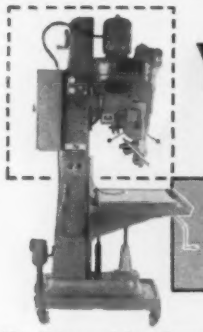
Rollway Maximum Bearings are used in the McDonnell Voodoo Jet

Gunned by higher speeds and higher temperatures, the performance demand for anti-friction bearings rises sharply every year. Here at Rollway, we strive always to keep abreast of the trend, and even to anticipate it. In precision, dimensional stability and simplicity, Rollway Maximum Bearings offer performance based on advanced thinking to original equipment and replacement buyers of today.

Start now, up-grade both your production machinery and your products with Rollway *bearings of the future*. Rollway Bearing Company, Inc., Syracuse 4, N. Y. Manufacturers of a complete line of radial and thrust cylindrical roller bearings.

ROLLWAY
Maximum
ROLLER BEARINGS

ENGINEERING OFFICES: SYRACUSE • BOSTON • CHICAGO • DETROIT • TORONTO • PITTSBURGH • CLEVELAND • MILWAUKEE • SEATTLE • HOUSTON • PHILADELPHIA • LOS ANGELES • SAN FRANCISCO



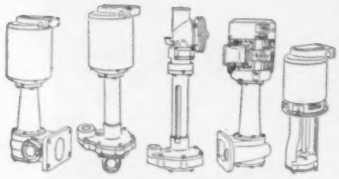
YOU GET BETTER PERFORMANCE

with Ruthman Gusher

This Howe and Fant Turret Drilling Machine is equipped with a Gusher Pump.

COOLANT PUMPS

Gusher Coolant Pumps give you split-second coolant flow from a trickle to full volume. There is no priming necessary, no seals or packing glands. The electronically balanced rotating shaft increases unit life. Maintenance costs are at a minimum. Efficiency in operation is at a maximum.



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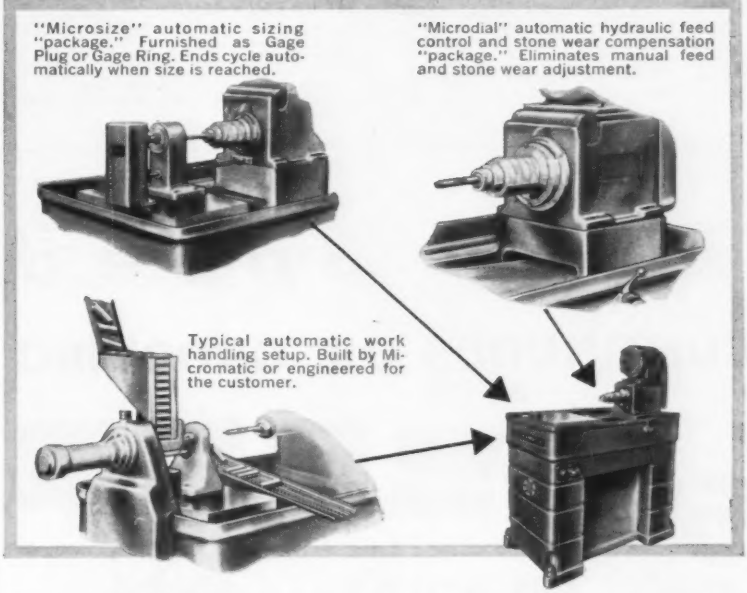
(Continued on page 354)

How NEW "150" HYDROHONER Can Be Automated to Any Degree . . . Easily . . . Economically


"Microsize" automatic sizing "package." Furnished as Gage Plug or Gage Ring. Ends cycle automatically when size is reached.
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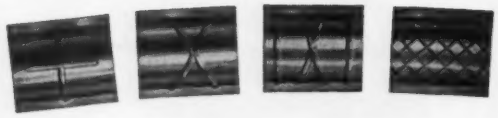
High Speed
CONTINUOUS OIL GROOVING



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PIECES PER HOUR!

High-production and economical operation are the features of the WICACO CONTINUOUS OIL GROOVER . . . capable of completing as many as 500 grooved pieces per hour in routine practice—even with unskilled labor!

The operator loads and unloads the work **without stopping the Machine**—a valuable time-saving advantage made possible by the WICACO upright construction of the spindle and stationary chuck. Feed-lever automatically returns to neutral position when cutting tool reaches its proper depth. The spindle—not the chuck—revolves, permitting fast and convenient grooving of a variety of larger and irregular work. Maximum depth of groove 7/32", maximum width 3/8", grooves may be cut in work from 1/4" I.D. to 4 1/2" I.D.; standard chuck holds work to 4 1/2" O.D.; stroke of spindle from 0" to 7"; floor space 24" dia.; weight of machine about 950 lbs.

Send us sample bearings to cut to specifications. We will return them, properly grooved, with a record of the time required and a cost-estimate. No obligation. Or, write for detailed, well-illustrated Bulletin.

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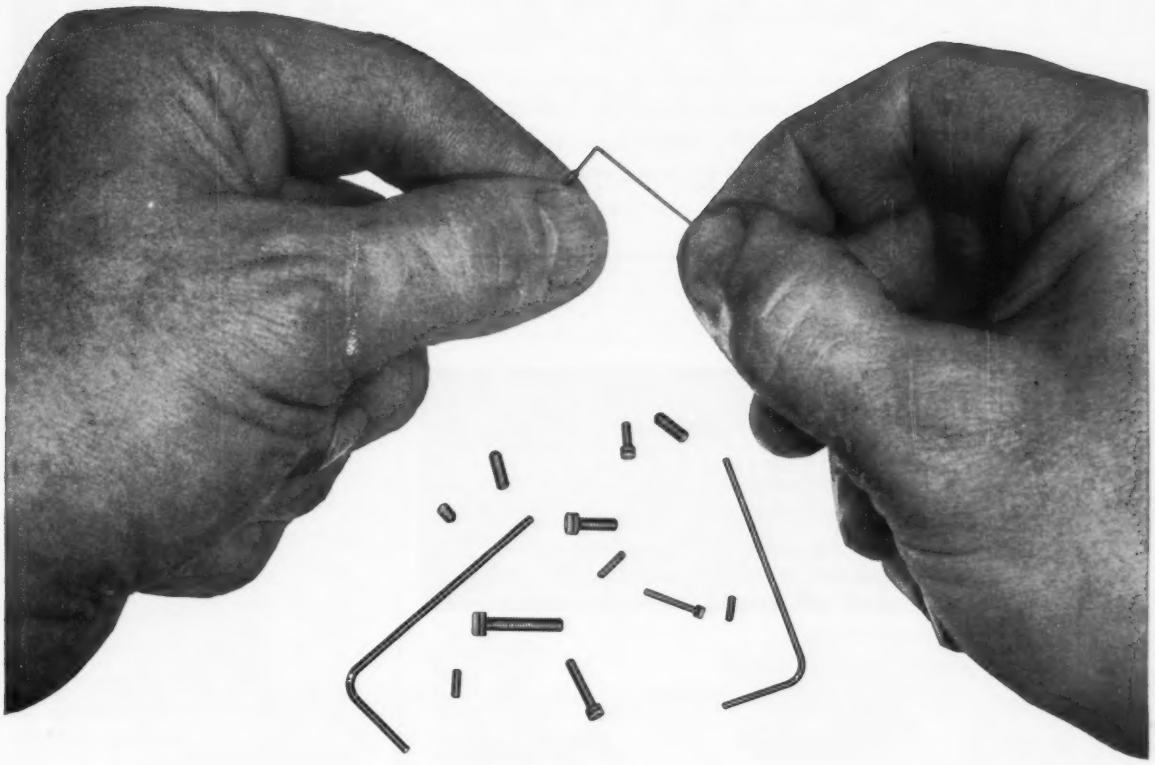

If you're miniaturizing . . . you'll save space, time and money with Allen Minicaps and Minisets (#0 thru #3 dia.)

These miniature Allen Hex Socket Cap and Set Screws will let you scale down your product sizes even farther. They're made from Allenoy special alloy steel — so strong that you can safely specify fewer screws or smaller sizes.

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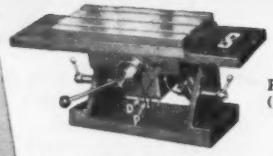

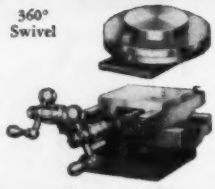

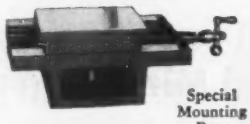

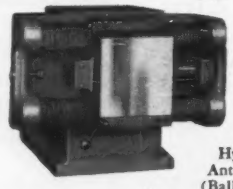

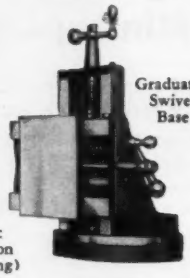

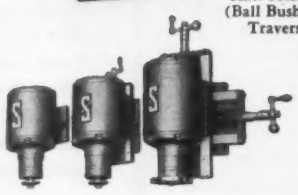

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(Continued on 358)

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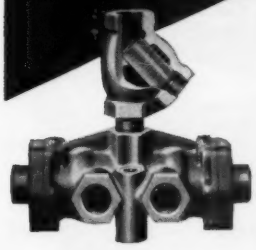

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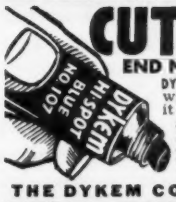

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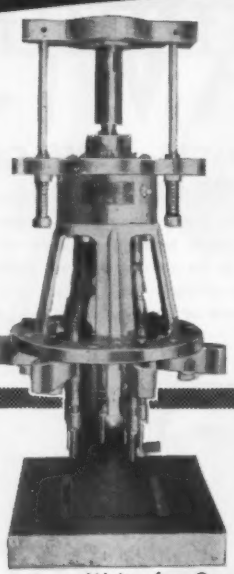

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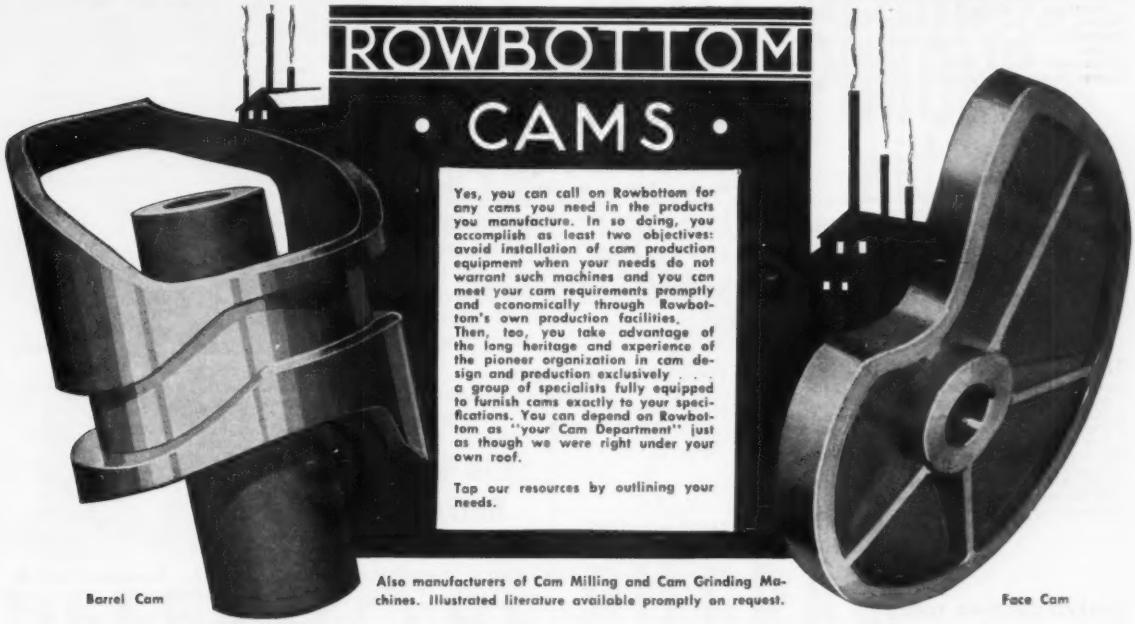

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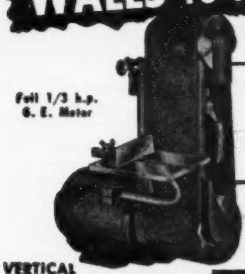

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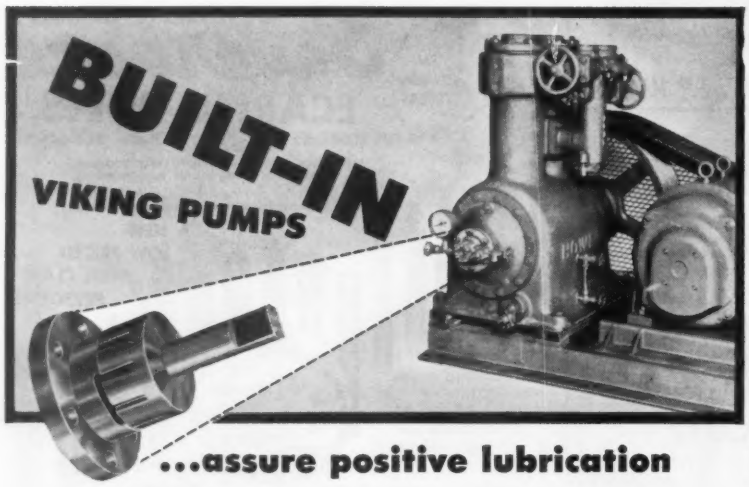

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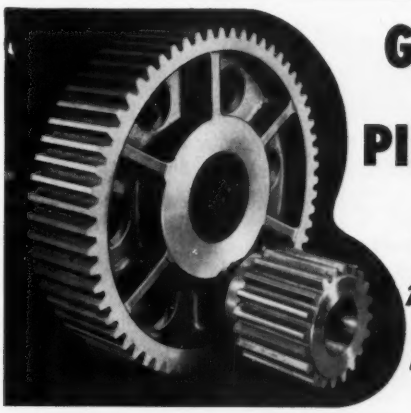

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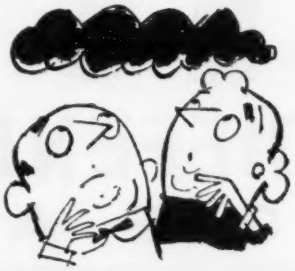

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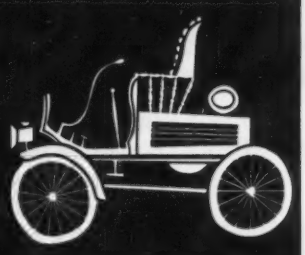

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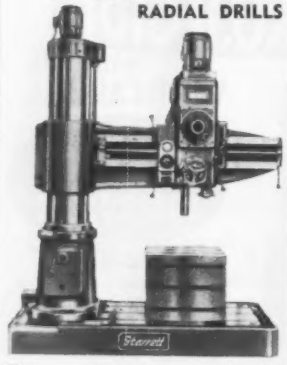

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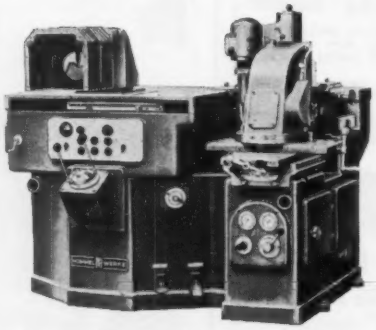

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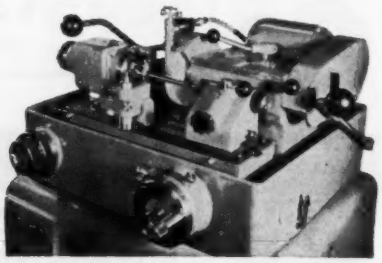

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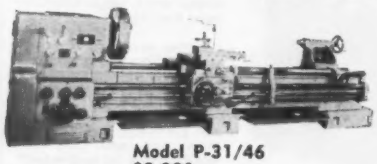

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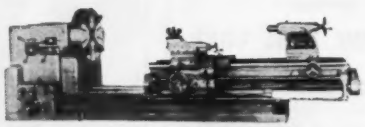

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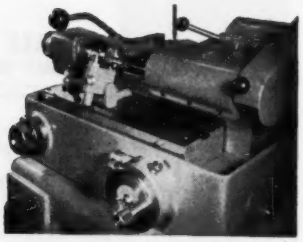

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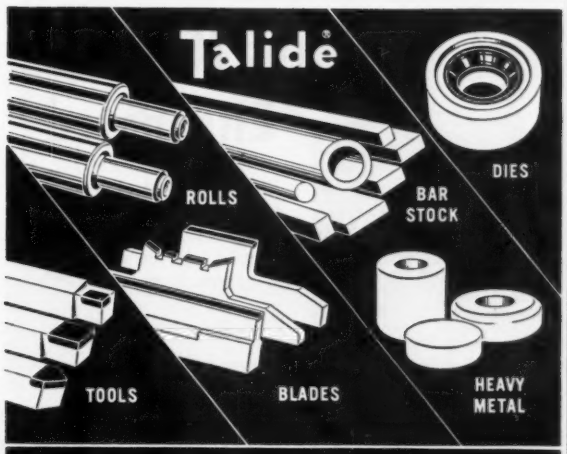

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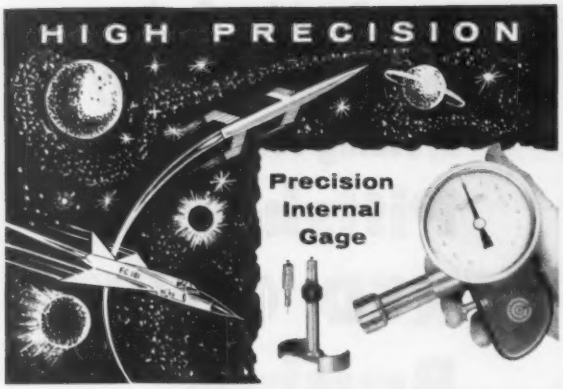

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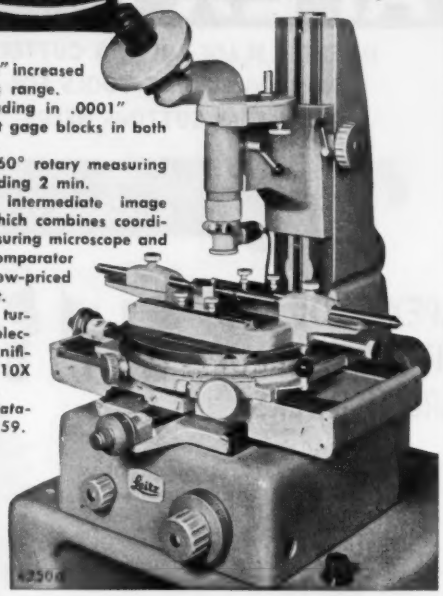

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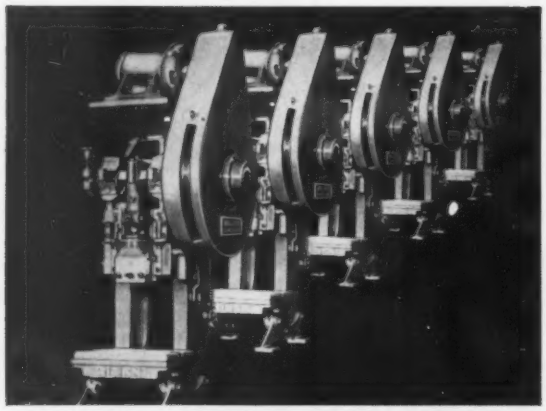

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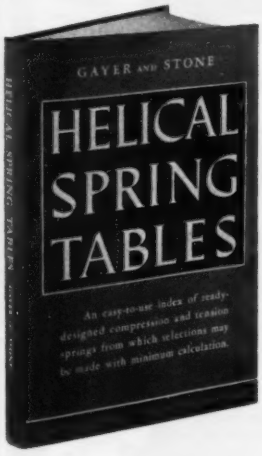
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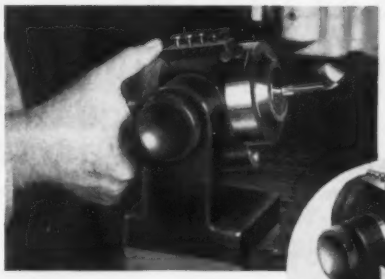

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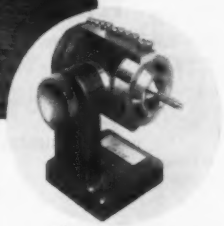

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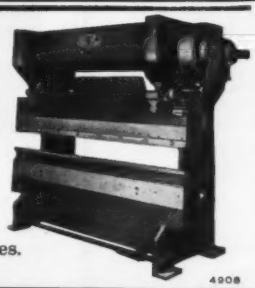

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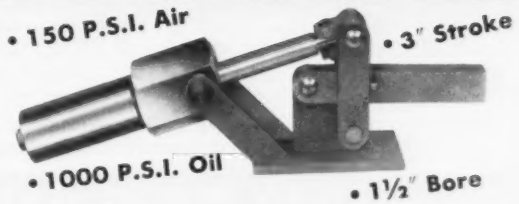

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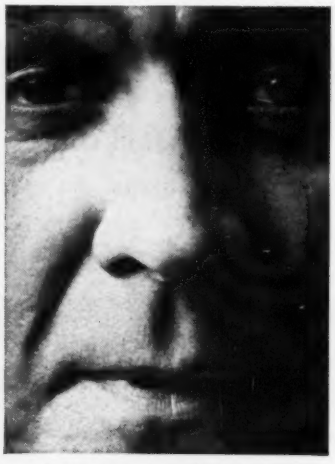

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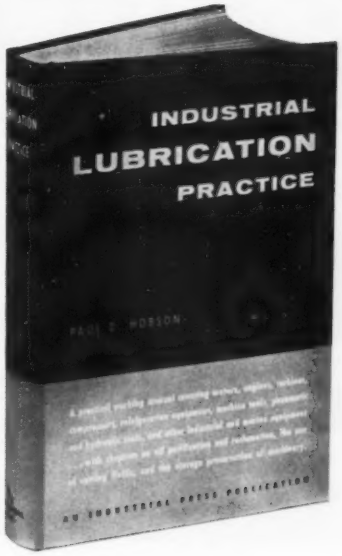

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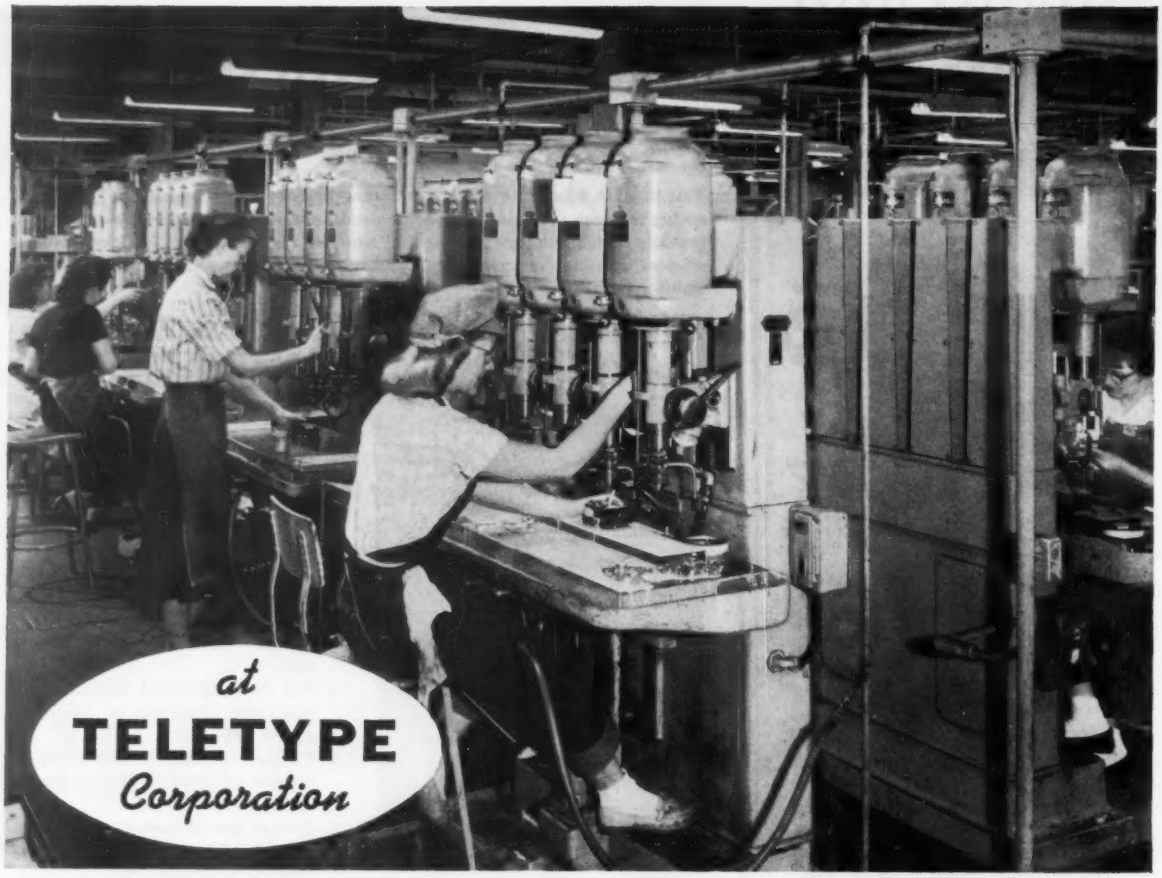

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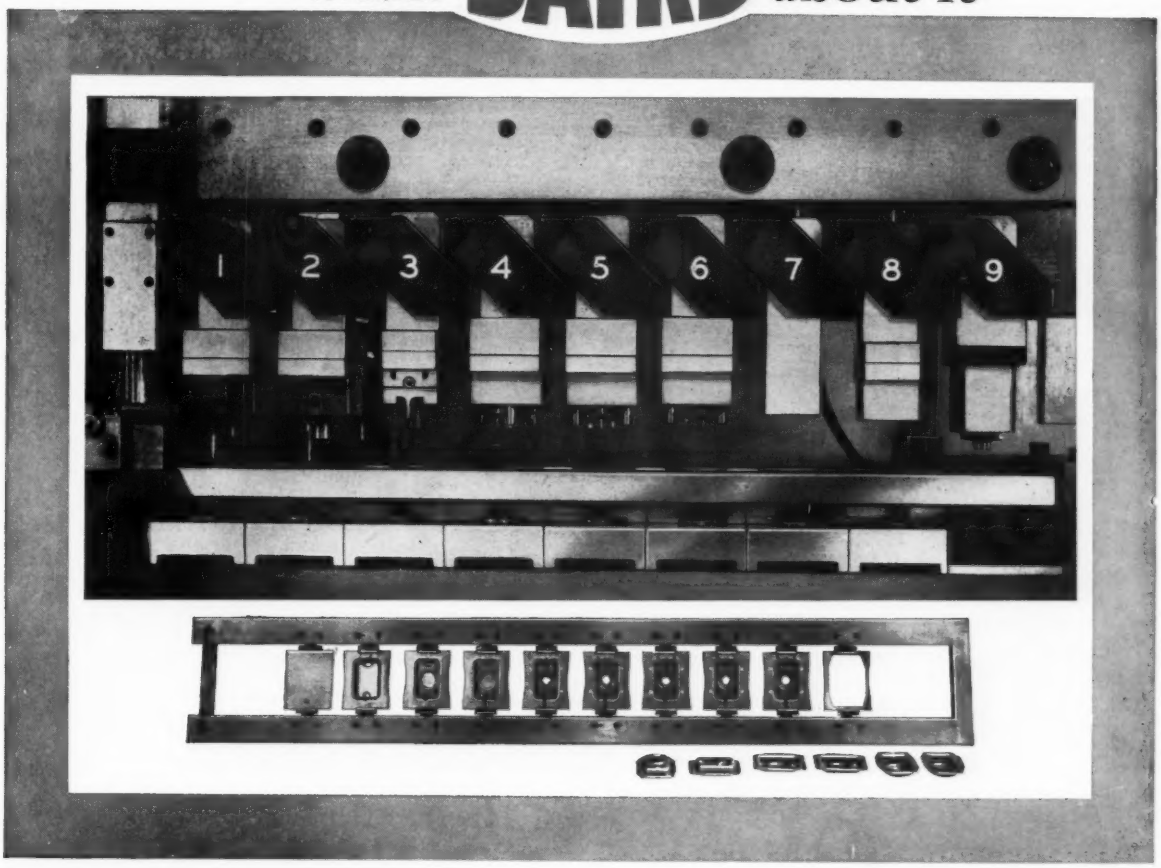

How to make money on a "FOUR-FOOT PRODUCTION LINE"

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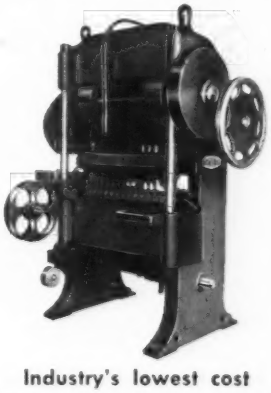

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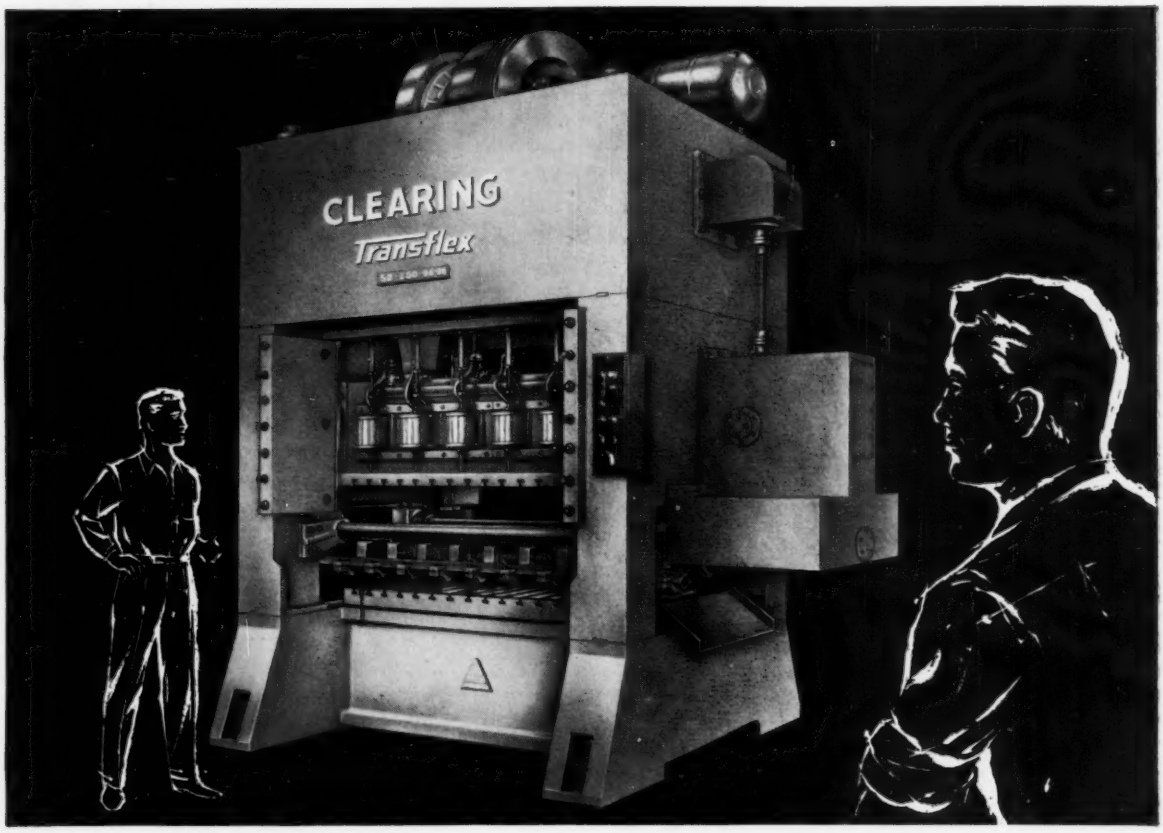
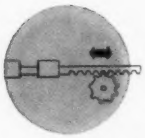


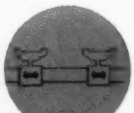
Press automation for small parts at moderate cost?

Yes, with a Clearing Series-S Transflex Unit



Operating station center-distances are variable.

Feed fingers readily adjust for different sizes of parts.



Die cushions are adjustable right to left.

Knockout positions adjust right to left.

Transflex—transfer feeding plus the ability to produce a variety of parts—has now been applied to Clearing Series-S presses. These moderate priced straight side presses are produced in capacities from 75 through 300 tons.

These presses have all the major adjustment features typical of all Transflex units. In addition, provision is made for fast detachment of the finger bars so that die changes are quick and easy. Feed change-over—as required from part to part—is practically instantaneous.

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